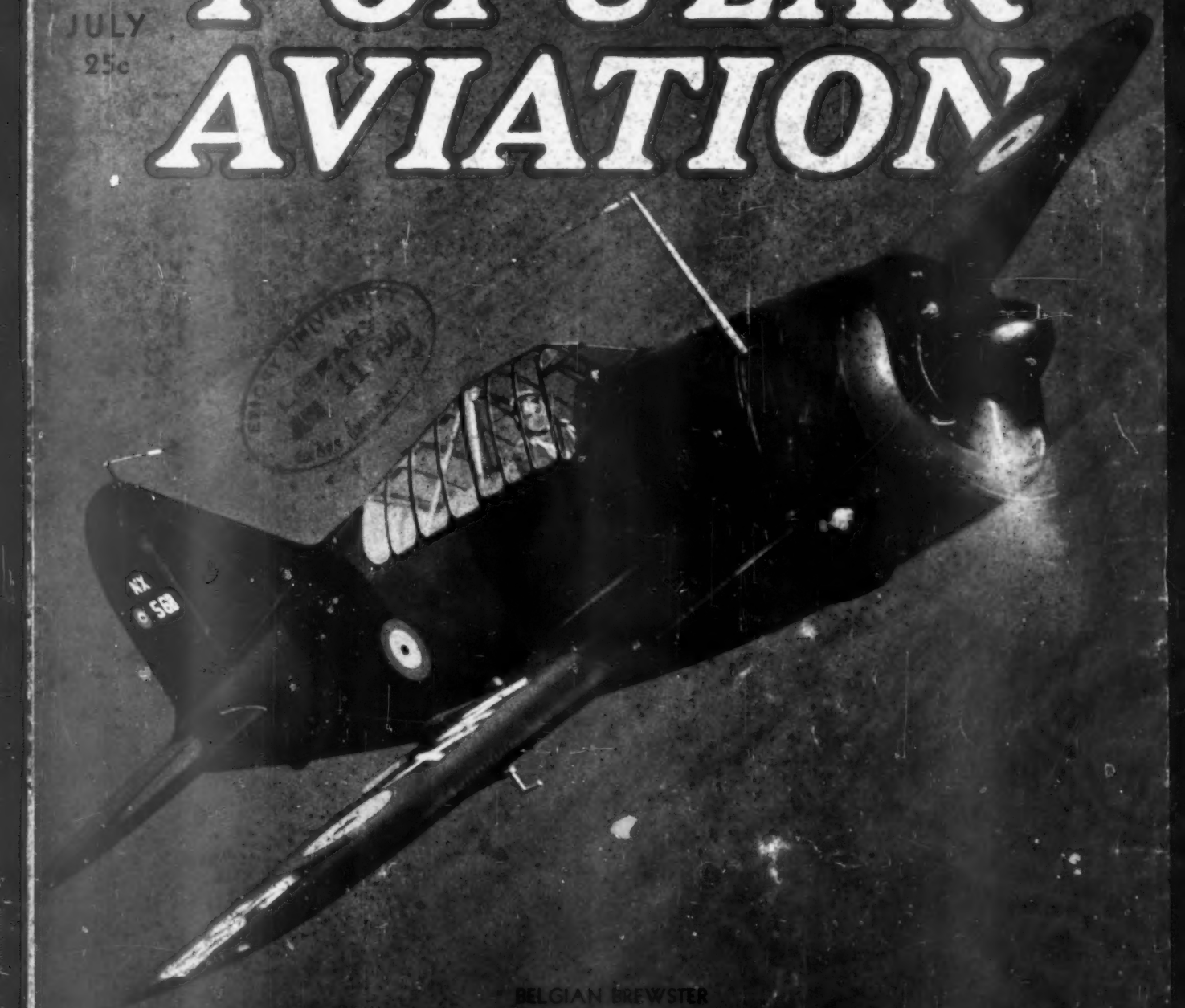
HOW STRONG IS THE ITALIAN AIR FORCE?

POPULAR AVIATION

JULY
25c



BELGIAN BREWSTER
See Page 99

EXCLUSIVE! UNCENSORED REPORT from the FRONT

★

STALLS and SPINS MUST GO *by* **Tom Hardin**

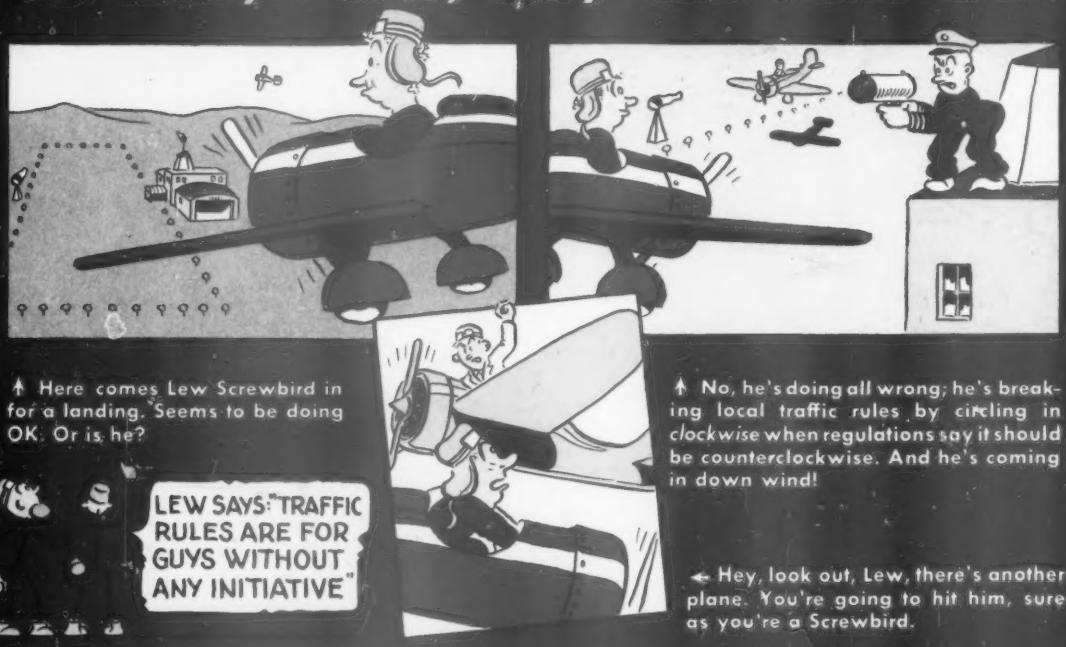
★

COAST TO COAST *for* **FUN**

336 Used Planes
See Page 92

DON'T BE A SCREWBIRD!

For safety's sake, obey local traffic rules



↑ Here comes Lew Screwbird in for a landing. Seems to be doing OK. Or is he?

↑ No, he's doing all wrong; he's breaking local traffic rules by circling in *clockwise* when regulations say it should be counterclockwise. And he's coming in down wind!

← Hey, look out, Lew, there's another plane. You're going to hit him, sure as you're a Screwbird.

↑ Phew! That was too close for comfort . . . Any nearer and there would be one less Screwbird and probably one more innocent victim.

When getting in and out of airports, paste this rule in your flying helmet: "Local traffic regulations are designed to safeguard flying." That's the advice of the Air Safety Board; advice that is always taken by <u>old</u> pilots.

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SHELL

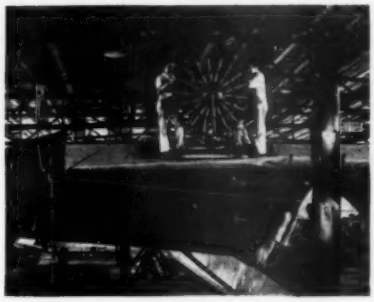
AVIATION PRODUCTS

Mr. Bruce Braun (left), Vice-President of Chicago & Southern Air Lines in charge of operation, discusses personnel problems with Mr. Oliver L. Parks, President of Parks Air College and Mr. Willis D. Gremp who is nearing the completion of his Professional Flight training at Parks. The group is seated in one of the new 21-passenger Douglas Airliners which C&S put in service May 1st.

According to Mr. Braun, "Nothing in the operation of our airlines is given greater attention than the character and training of our personnel."

Above—Final check-up of two-way radio equipment before installation in plane.

Below—Parks Air College students getting practical training in engine installation.



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Section PA-7

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JUST 11 years ago General Billy Mitchell wrote a series of articles for POPULAR AVIATION that would make our "preparedness-minded" politicians squirm today. In 1929 Billy Mitchell described in detail how the United States is vulnerable from the air. He got crucified for his efforts to make America safe from aerial attack. Now Hitler has accomplished what Mitchell was unable to do. President Roosevelt recently asked for—and undoubtedly will receive—appropriations for some 50,000 military aircraft. Whether or not America's "awakening" is in ample time remains to be seen. In his POPULAR AVIATION articles Mitchell even mapped out an aerial attack on this country—through Iceland, Greenland and Newfoundland! How real this threat is today, every American knows. Mitchell told us that attack might come also from the south: Mexico, Latin America, the Panama Canal and South America. All these warnings are dangerously close to being realities.

* * *

IT was at least four years ago that this writer, then a contributor, wrote about 2,500 words to the effect that the private airplane could and should be made safer. The aviation industry didn't like it. But gradually, the airplane as we know it today has been refined until it has comparatively few faults. Except, of course, the capacity to stall and spin. If what we said a few years ago sounded radical, we wonder what the answer will be to "Stalls and Spins Must Go!" on page 14? The author is no radical; Tom Hardin was a veteran airline pilot who had flown just about everything flyable before he joined the Air Safety Board of the C.A.A. So, those few manufacturers who insist on lagging behind the parade might well heed Mr. Hardin's advice.

* * *

WHAT'S-In-The-Wind Department: a B.B.C. short-wave broadcast from the Western Front the other evening accidentally got the sound of German air bombs bursting during a raid . . . the British announcer was at the French base of that British fighter squadron of which that daring young New Zealander is a member . . . it was reported that the young fellow had just that day shot down three Nazi bombers, bringing his score to 16 . . . Though the House of Representatives turned thumbs down on President Roosevelt's plan to move the C.A.A. back to the Department of Commerce, F.D.R. put the heat on certain senators and got his way after all . . . Remember that Consolidated PBY sold

(*Continued on page* 91)

POPULAR AVIATION
Trade-mark Registered

Volume XXVII Number 1

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Airplane Construction and Operation: Essential components of airplanes. Historical development. Weight, loads, load factors. Center of gravity determination. Stresses on airplane parts. S.A.E. steels. Magnetic dust inspection of steel. Aluminum alloys. Bend allowance calculations. Riveting sheet metal. Fabric doping and finishing, repairing, inspecting. Dopes and lacquers. Cable splicing. Airplane structural details. Tube and spar splicing. Flying procedure. Operation with flaps and nose wheel. Elementary acrobatics.

Aircraft Propellers: Propeller theory. Operation with controllable propeller. Automatic propellers, hydraulic and electric. Construction of wood, steel, duralumin propellers. Propeller track and balance. Measuring propeller pitch.

Engine Principles: Theory of internal combustion engines. Otto cycle, Diesel cycle. Compression ratio and efficiency. Brake and indicated horsepower. Brake mean effective pressure. Octane rating. Thermal efficiency and specific fuel consumption.

Engine Construction and Operation: Types, radial and in-line. Controlling factors in operation. Terminology and construction of modern engines. Fuel, lubricating, cooling, ignition systems. Vibration and balance. Practical operating procedure. 20-hour check. Data for top overhaul.

Engine and Flight Instruments: Minimum equipment requirements for instrument night flying, for contact flying. Construction and operation of aircraft engine instruments, including tachometers, pressure gages, oil and liquid thermometers, fuel quantity gages. Construction and operation of aircraft flight instruments, including air-speed indicator, altimeter, rate-of-climb indicator, bank indicator, gyroscopic rate-of-turn indicator. Gyro Horizon, directional Gyro. Instrument flight training.

Safety Appliances and Communications: Parachutes: construction and care. De-icing equipment. Aeronautical communication. Collecting and distributing weather information. Two-way aircraft radio. Aircraft station equipment. Receiving and transmitting antennas. Radio interference. Radio range and marker beacons. Direction finders. Instrument landing system.

Avigation—Maps, Piloting, Radio, and Instruments: Value of avigation. Map making principles. Map projections used for avigation. Piloting technique and aids. Radio avigation. Construction and operation of avigation instruments. Magnetic compass and compass compensating systems. Swinging the compass. Compass deviation card. Time of flight indicator. Drift indicator. Ground-speed indicator.

Dead Reckoning: Basic principles. Headings, pointings, and courses. Rules for correcting for variation and deviation. Velocity vectors. Velocity triangles for graphical solution of dead reckoning problems. Double drift method. Determination of drift without drift indicator. Avigator's procedure sheet. Preparing a Flight Plan. Radius of action and interception problems.

Aeronautical Meteorology: Definitions. Elements of meteorology with measuring device and unit or expression employed. Adiabatic expansion and compression. Temperature. Dynamic cooling. Cooling by conduction and mixing. Identification of air masses. Pressure. Humidity. Condensation. Cloud types. Visibility and ceiling measurement. Precipitation. General and local wind systems. Veering and backing winds. Beaufort scale of wind speed. Sunshine. Lightning. Communication of weather information. Content and translation of Symbol Weather Reports. Weather and air masses. Warm and cold fronts. Airway Weather Maps. Development of cyclones. Weather forecasting.

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Designed to help its users meet official requirements, *Air Piloting* supplies in detail the flight training instructions needed by student pilots and also by certificated pilots who desire to get higher ratings. In addition it will be helpful to flying instructors and to pilots who wish to obtain the instructor rating.

AIR PILOTING proceeds step-by-step from preliminary preparation for the first flight to piloting by instrument. The flight test maneuvers required for the various pilot certificates are completely analyzed and explained, with diagrams of maneuvers to illustrate every step in their correct execution and make them clear and easy to understand. In addition to full instructions on primary essentials, the manual contains much information on advancing flying techniques, including exhibition acrobatics. Its descriptions of average faults and explanations of their causes will help you gain increased skill in precision flying—the mark of the expert pilot.

To help you make sure of passing the written tests, too, the book contains lists of specimen questions—totaling 377—taken from official examinations for all grades of pilot certificates. The answers that examiners accepted as correct accompany these questions.

PARTIAL OUTLINE

General Considerations: Advice to beginners. Pilot ratings. Safety precautions. Ten Commandments of safe flying. Relaxation and how to obtain it.

Airplane and Controls: Wings. Fuselage. Engine and propeller. Control surfaces. Control parts. Landing gear. Pilot's equipment.

Primary Flight Training: Primary dual instruction. Preparation for first flight lesson—explanation of controls. First thirteen dual lessons: Gentle turns off line. Medium-bank turns off line. 180° turn across line. Skids. Slips. Taxying. Skids and slips in turns. Glides: use of throttle. Climbs. Demonstration of increase and decrease in flying speed. Three-stage "landing" in the air. Gliding turns and spirals. Approaches. Take-offs. Landings. Elementary forced landings. Contour flying: slipstream flying. Stalls. Spins.

Civil Air Regulations: Selected air traffic rules which must be thoroughly mastered by student pilots preparing for government examinations.

Practice Maneuvers: Shallow, circular, steep eights. Triangulation spirals. The 180°, 360°, 1080° spirals; vital factors to keep in mind. Practicing stalls with and without power. Primary and advanced spins. Procedure for the 720° vertical bank. Cross-wind take-offs and landings. Forward and sideslips; slipping turn. Advanced figure eights; vertical figure eight. Precision maneuvers. Night flying. The split-S turn. Chandelle. Skyline eight. Half roll. Barrel roll. Loops. Falling leaf. Common faults in maneuvers; how to recognize and overcome them. Latitude given government inspectors to go outside routine maneuvers to test candidate's competence. Increase of degree of precision required in execution of maneuvers at each rating stage.

Cross-Country Flying: Map reading. How to lay out a cross-country course. Facilities provided by Federal airways. Preparation for cross-country flight with detailed explanation of pilot's procedure.

Airways Radio: Radio-range orientation described and illustrated—90° method, parallel bisector method. Radio compass navigation; fundamental principles explained. How to obtain bearings. Establishing fixes. "Homing." Combined radio-range and radio-compass navigation.

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Aviation Radio Communications: How to secure an operator's license. International Morse Telegraph Code and how to learn it. Keying. Practice exercises.

Fundamentals of Electricity: Electron theory. Static, current electricity. Ohm's Law. Conductors. Resistances. Insulators. Magnetic induction.

Radio Electricity: Series resonance. Coupling. Choke Coils. Mutual inductance; transformers. Capacity, Farad, Condenser. Inductive, capacitative reactance. Impedance, resonance.

Radio Circuits: Receiving, transmitting, oscillatory circuits. Frequency, wave length, waves. Conductors in series. Antenna, parallel, coupled circuits. Matching by tapped circuits. Filter, bridge circuits. Antenna types. How tubes are selected. Amplification. Radiation characteristics, resistance. Field intensity. Tuning antenna circuits.

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Radiotelegraph Transmitters: Oscillatory, frequency control. Meissner, Colpitt, Hartley circuits. Tank circuits. Crystal-controlled oscillators. Transmitting tubes. Frequency multipliers. Radiotelegraph transmitter circuits. Transmitter with harmonic generator. Aerovoice. TBK transmitters. Modulator-Rectifier unit. Circuits to study.

Radio-Range Beacons: TMH model airway radio range beacon transmitter. Marker beacons (Class M). Simultaneous radio range beacon. Frequency range. Crystal oscillator. Buffer, intermediate amplifier. Modulator. Keying devices. "Fan" type ultra-high frequency radio markers. Cone of silence (Z) marker.

Radiotelephone Transmitters: Basic modulation systems. How to check modulation. Speech input circuits. Single-, double-button carbon microphone. Western Electric, RCA, Bendix aircraft and ground station transmitters.

Receivers: Design Requirements. Reception, detection methods. National, Western Electric, RCA, Bendix receivers.

Direction Finders: Radio compass indicators. Dieckman & Heil radio compass. Cathode-ray type compass. Simon radioguide. Kruesi radio compass. Lear radio-compass receiver. RCA radio compass. Western Electric radio-compass attachment. Radio Frequency Laboratories Radio-beacon compass receiver.

Instrument Landing Systems: Air-Track, Lorenz, International Telegraph Development Company systems. Operation of a complete instrument landing system.

Radio Traffic Control: Specifications for airport traffic-control receiver; for transmitter. Traffic control procedure.

Installation of Equipment: Tests for efficiency of bonding. Requirements of shielding assembly. Ignition shielding. Choosing, installing antenna. Wiring the airplane. Installing power supply units, transmitters, receivers.

Maintenance: Routine inspection. Maintenance of generators, transmitters, receivers. Aircraft radio servicing.

Appendix: Standard graphical symbols used in radio engineering. Definitions of terms used in radio engineering.

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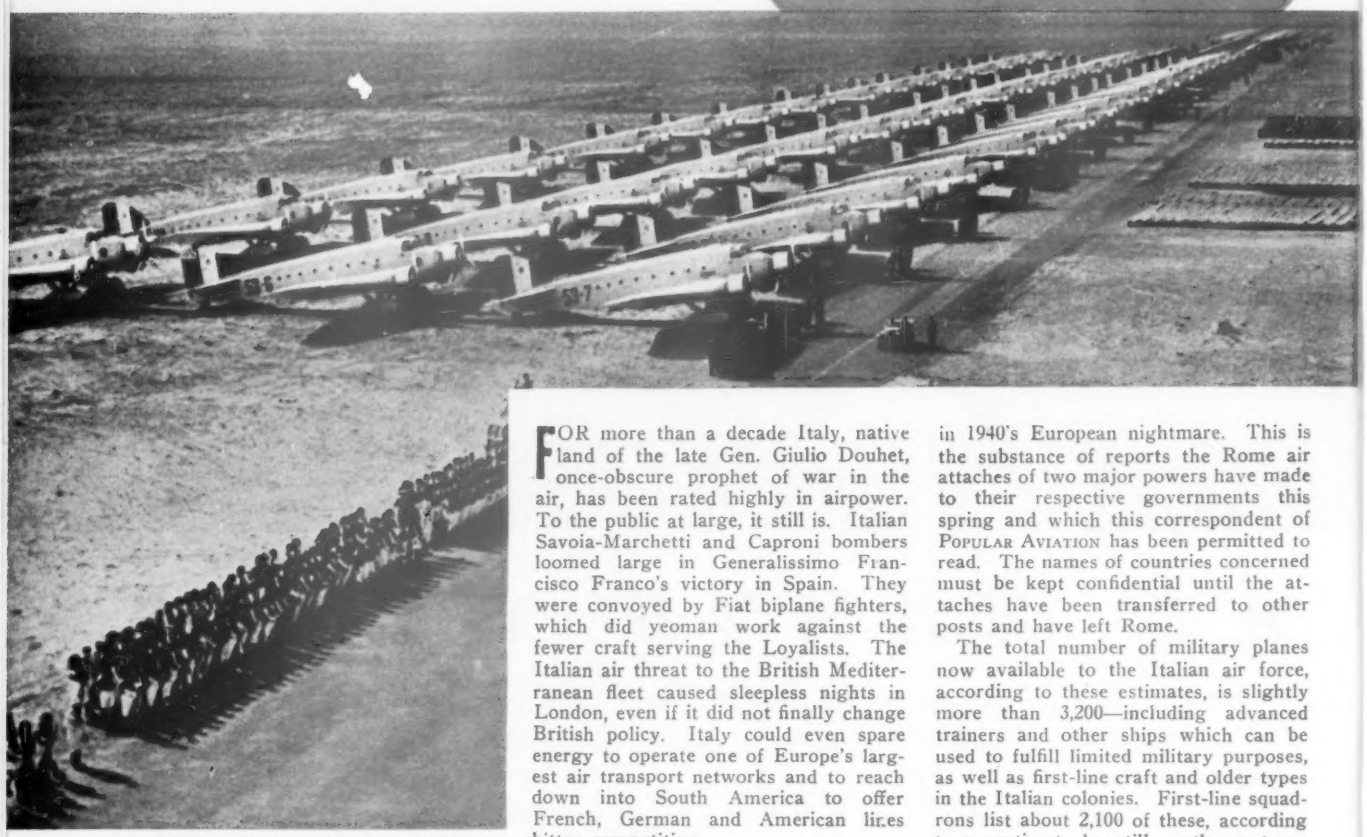
IS ITALY AN AERIAL THREAT?

By
LEONARD ENGEL

Perhaps Italy will be in the war by the time this goes to press. But experts say her air force has been dangerously depleted, is no match for the Allies.



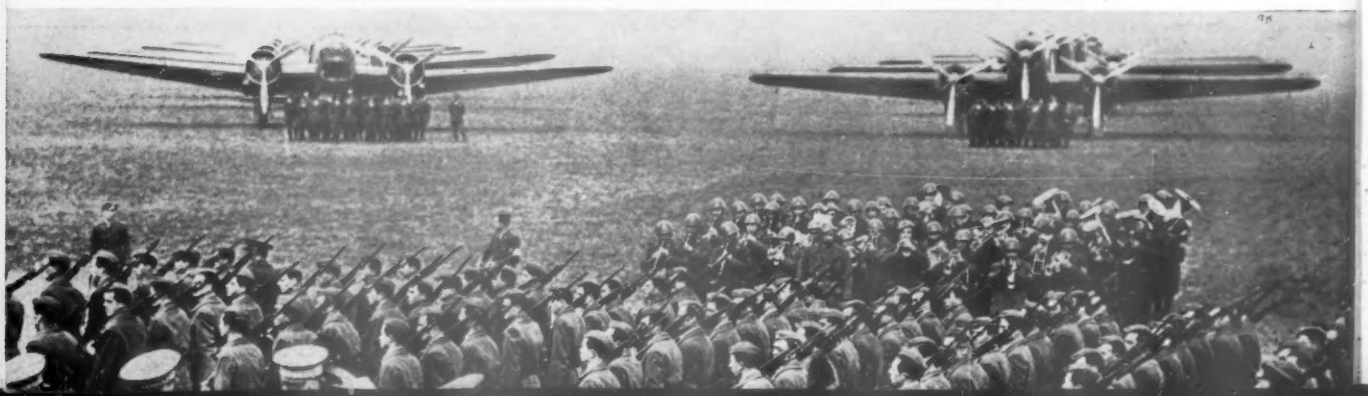
Italian bombers shown lined up on Libyan airport are old Savoia-Marchetti S-81's.

FOR more than a decade Italy, native land of the late Gen. Giulio Douhet, once-obscure prophet of war in the air, has been rated highly in airpower. To the public at large, it still is. Italian Savoia-Marchetti and Caproni bombers loomed large in Generalissimo Francisco Franco's victory in Spain. They were convoyed by Fiat biplane fighters, which did yeoman work against the fewer craft serving the Loyalists. The Italian air threat to the British Mediterranean fleet caused sleepless nights in London, even if it did not finally change British policy. Italy could even spare energy to operate one of Europe's largest air transport networks and to reach down into South America to offer French, German and American lines bitter competition.

Mussolini's air force today, however, is small, obsolescent and of small account in 1940's European nightmare. This is the substance of reports the Rome air attaches of two major powers have made to their respective governments this spring and which this correspondent of POPULAR AVIATION has been permitted to read. The names of countries concerned must be kept confidential until the attaches have been transferred to other posts and have left Rome.

The total number of military planes now available to the Italian air force, according to these estimates, is slightly more than 3,200—including advanced trainers and other ships which can be used to fulfill limited military purposes, as well as first-line craft and older types in the Italian colonies. First-line squadrons list about 2,100 of these, according to an estimate by still another veteran military observer with long experience in Italy. American military observers

Lined up for review below are Fiat BR-20 and Savoia-Marchetti SM-79 bombers. Both are first-line ships.



in Spain have estimated that Italian participation in the Civil War cost Mussolini a thousand planes, which might have come in handy now. Five hundred were shot down by the Republicans and another 500 were left behind when the Italians finally departed after the war was over.

The bulk of the 3,200 planes now on hand are obsolescent largely because recent models, with one exception, have had to be abandoned for one reason or another and because of engine difficulties. Older types have had to be kept in service.

The Fiat CR-32 and a somewhat more modern version, the CR-42—both designed by a well-known Italian engineer, Rossitelli (the C in the planes' designation means "caccio," Italian for pursuit, and R for Rossitelli)—still are the combat squadron's mainstays. They are both biplanes powered by in-line and radial engines in the 1,000 h.p. class. A talented engineer, Grasselli, on the staff of Fiat—which makes everything from power-driven hand tools to airplanes—turned out the G-50 which was to be the replacement for the older Fiats. The G-50 resembles the P-36 strongly, with its Fiat radial engine and low monoplane wing. But it proved too expensive and the 100 in the original order have been abandoned. Fifty of these were among the Italian planes sent to Finland—via France, by the way, and not via Germany as reported by the newspapers. The other 50 still are with the Italian air force.

Present Italian hopes center around the Macchi 200, a low-wing monoplane with a top speed around 325 m.p.h. The Macchi 200 is about two years old but, even so, not very many are in service. Macchi is the designer who built the seaplane in which Lt. Francisco Agello set the 440 m.p.h. speed record that stood for more than four years before a modified Messerschmitt Me-109R broke it. Between then and now, however, the Macchi concern has been busy largely with producing wings for Savoia-Marchetti bombers and not in turning out its own designs.

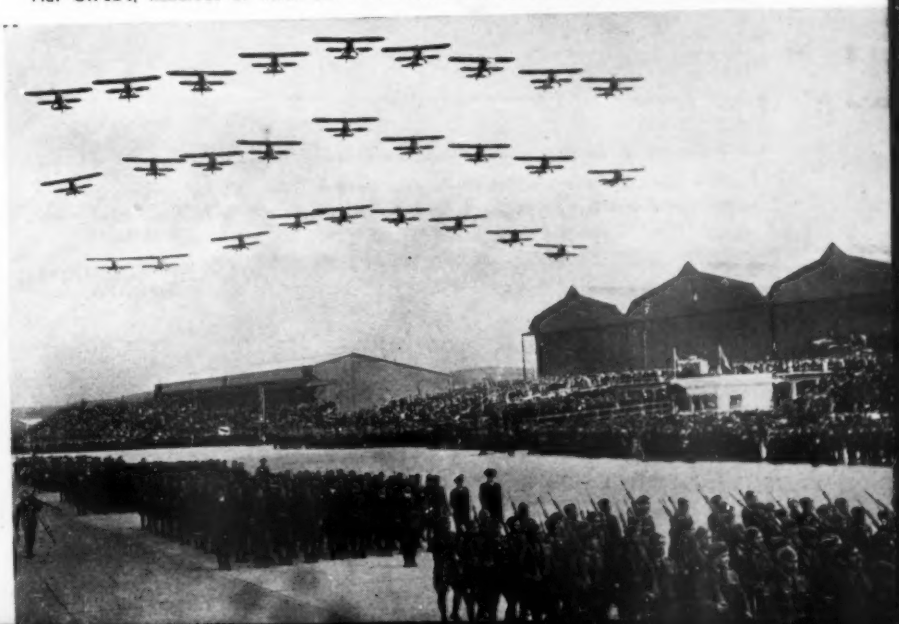
Standard bombers still are the Savoia-Marchetti SM-79 and the remarkably similar looking Caproni tri-motored bombers. The SM-79, developed from the earlier SM-81, did well in Spain. Its high speed, up around 275 m.p.h., was fast for a bomber two and three years ago. Big bullets like the Douglas A-20, the 375 m.p.h. attack bomber, weren't even thought of then. The SM-79 gained its performance from the fact that it has a high wing-loading. The Italians were among the first to go to the high wing-loading. But since then the rest of the world has learned that trick and has produced a few tricks of its own, such as far more powerful engines than the Italians have. Hence the SM-79, instead of being ahead of the parade, is now well behind it.

It is the best the Italians have in service. A good deal of fuss was made almost a year ago over a twin-motored high-wing job, the Breda 88, which was

Standard Italian attack-bomber, similar to U. S. Army Northrop A-17A, is this Breda "65". Powered with an 870 h.p. radial engine, "65" has 267 m.p.h. top speed, six guns.

Caproni AP-1 is two-place, single-engined light attack-bomber. Similar to Breda "65", AP-1 has fixed landing gear. Performance figures and armament data are not disclosed.

Flying past in review before Premier Mussolini is a fighter squadron. Planes are old Fiat CR-32's, hundreds of which saw wide service in the recent Spanish Civil War.



Savoia-Marchetti SM-79 is staple Italian air force bomber today. Engines are three 750 h.p. Alfa-Romeos, top speed 270 m.p.h., cruising 248. Maximum armament: four guns.

New but hard-to-fly bomber is the Breda "88". Powered with two 1,000 h.p. engines, top speed is 321 m.p.h., range with 2,200 lb. load: 1,120 miles. Ceiling is 27,000 ft.

Bomber under tests is Caproni CA-135, twin-engined bomber. Engines are 900 h.p. water-cooled Isotta-Fraschinis. Another version (see below) is powered with radial engines.

Latest model Caproni CA-135 in use by Italian air force has 900 h.p. air-cooled engines. Top speed is 273 m.p.h. at 14,760 feet. It has low service ceiling: 22,960 feet.

Now in use by Italians is Fiat BR-20 heavy bomber. Two 1,000 h.p. engines give it a top speed of 268 m.p.h., cruising speed of 217. Range with 7,920 lbs. is 1,863 miles.

Widely used against Ethiopians was Caproni CA-101. Still used by Italians, it has three 370 h.p. engines, top speed of 155 m.p.h., cruising 127. Range loaded is 700 miles.

to serve as a medium bomber, fighter or scouting machine and in a sense to replace the older ships as well as supplement them. Short and stubby, with its Piaggio 1,000 h.p. radials, the Breda 88 is plenty fast—around 340 m.p.h. Unfortunately, however, it lacks longitudinal stability so badly as to be nearly unflyable. At least two attempts were made to rebuild the tail assembly of the 100 the Breda factory turned out, but they did not work. Breda is better known for its Model 65, a single-engined attack plane which resembles American attack ships and has been used for some time.

Those familiar with the Italian picture say that Italian aviation's weakest department is engine design and production. England and Germany both have their 2,000 h.p. class engines in production, the former the Rolls Royce *Vulture* (which is really two Merlin V-12's placed back to back to form an X) and the latter a pair of Daimler-Benz 601A's similarly arranged. America has radial engines supplying any desired amount of power right up to 2,000 h.p. and an experimental Allison built around two of the 1,000 h.p. V-12 Allisons arranged fanwise. But Italy has no engine of more than 1,200 h.p. in service and the biggest ones in the experimental shops develop only 1,500 h.p. Alfa-Romeo, Isotta-Fraschini, Fiat and Piaggio each have a powerplant in this class. But only one—the Alfa-Romeo, which is reputedly rated at about 1,450 h.p.—is past the test stand. All are twin-row radials except for the Isotta-Fraschini, an in-line job. Horsepower may be the most expensive means of putting speed into an airplane, but the engineers have not yet found a way to dispense with it. Four hundred m.p.h. service planes are still a distant vision for Mussolini's designers.

With one or two striking exceptions, little really original design work now is going on in Italy, according to these same sources. If the frequency with which available copies of American National Advisory Committee for Aeronautics reports are borrowed by Italian engineers is any indication, these sources are correct. American design, particularly in engines, is the inspiration for a good many Italian practices.

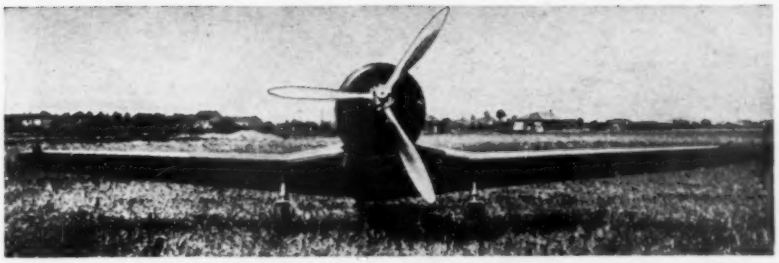
Most interesting new Italian development is the armament of a new four-motored Piaggio heavy bomber. Two .50 caliber machine guns are mounted to the rear of each outboard nacelle. They are aimed and fired by remote control by a gunner in the fuselage and sighting from a cupola above the top of the hull. This arrangement is aerodynamically cleaner than the average turret or blister. Most important, it gives protection to the gunner which no turret ever will unless it is armored, something which has not happened yet and is not likely to. Fire of the four guns is arranged to converge at a point just behind the tail. The idea is so good and so obvious it is surprising it has not yet been copied by other powers, who undoubtedly know about it despite the

secrecy surrounding development. One invention, however, cannot make an air force. Not even the dozens of inventions of greater or less importance Italians have worked out in past years can.

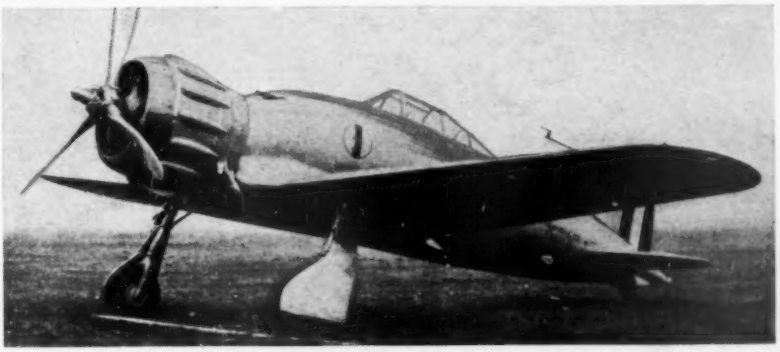
Yet at the same time, the personnel of the Italian air force is highly regarded, despite the limitations under which it works—a perennial gasoline shortage as well as, at the moment, definitely inferior warplanes. The Italian military pilot who adds more than 150 hours a year to his log is the exception. Italy has neither important oil deposits nor the immense coal resources which enable her ingenious German neighbor to make ersatz aviation fuel by the Bergius process. There are more than 4,000 pilots in Italy, most of them with military training (private flying is practically unknown). By way of comparison, France had about the same number on call the day war was declared. France is considered weak in pilots rather than in planes. Quite a number of the Italian pilots saw service in Spain and they are among Europe's better military airmen as a result of their experience.

The Italian air force is completely separate from the army and navy. Unlike England, where the bulk of naval aircraft (except for shore-based patrol planes) are under the Admiralty, only a minimum number of scouting planes come under the navy. Il Duce himself is Air Minister (along with half a dozen other cabinet posts he occupied at the last count). General Priccalo succeeded General Valle as Undersecretary for Air in the big cabinet shake-up last October which everyone thought was a sign Italy was coming over to the Allied side but actually seems to have resulted merely from Mussolini's habit of shaking things up every now and then in the interests of general efficiency.

Thirty-two hundred planes, of which quite a number are simply completely out of date, is not a large number of warbirds as air forces in Europe go these exciting days. No one has accused Germany of having less than 8,000 or 9,000 available at any time during the last year or two. The Allies between them must have at least 7,000 (of which many are not as modern as corresponding German craft). Mysterious Soviet Russia is rarely thought to have less than 4,000 in first-line squadrons scattered from the Finnish frontier to Vladivostok—and she may have a lot more. It is therefore easy to understand the somewhat condescending attitude toward Italy many statesmen have whose business it is to know about this state of affairs. For her army—according to a report which Marshal Badoglio, grand old man of Italian soldiering, made to Mussolini about the time England and France were declaring war on Germany—is also in a similar fix. He said it would not be in a position to carry out a major military operation for months and possibly years to come.



Current monoplane fighter is Fiat G-50. Engine is an 850 h.p. Fiat. Top speed at 14,760 feet is 299 m.p.h., range 435 miles. The G-50 carries four guns and 36 small bombs.



One of the latest single-seat fighters is the Macchi C-200. Engine is 840 h.p. Fiat, top speed 313 m.p.h., range 435 miles. Armament is two guns. Note American propeller.

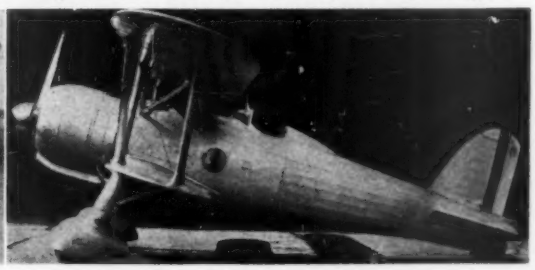
Yet once Italy stood in the front rank How can this shift in position be accounted for? It is simply that Italy had a headstart by being one of the first major powers to become air conscious. The others have become airminded since then, however, and by virtue of their greater resources have passed her. Italy has neither the resources nor the industrial plant to keep up. No country's air force can be better than its industrial base generally. Of the six major types of commodities required by a 20th century war machine, Italy is self-sufficient only in one; food. By pulling in her belt and with the aid of her African colonies, poor though they are, she can feed herself adequately if not well. But her coal, oil, iron ore, chemical and rubber resources are practically negligible. This winter, closing of the sea route which formerly brought German coal from Hamburg to Genoa, and refusal of the British to sell Welsh coal except on political terms which Italy was unwilling to meet, deprived Italians of heat in their homes and brought factories still running despite the Allied blockade to the verge of shutdowns. Materials for the high test steels which make air engines possible are difficult to obtain, for example. Fiat, Alfa-Romeo and Isotta-Fraschini are about finished turning out 1,000 engines for the Allies. The Allies had to deliver raw materials as well as cash in advance.

Italy is so strapped financially that she long ago resorted to foreign exchange and currency control and to barter agreements in most of her foreign trade. The purchase of American or (before the war) British Empire raw materials, is on a cash basis to be paid eventually if not on the barrel head.

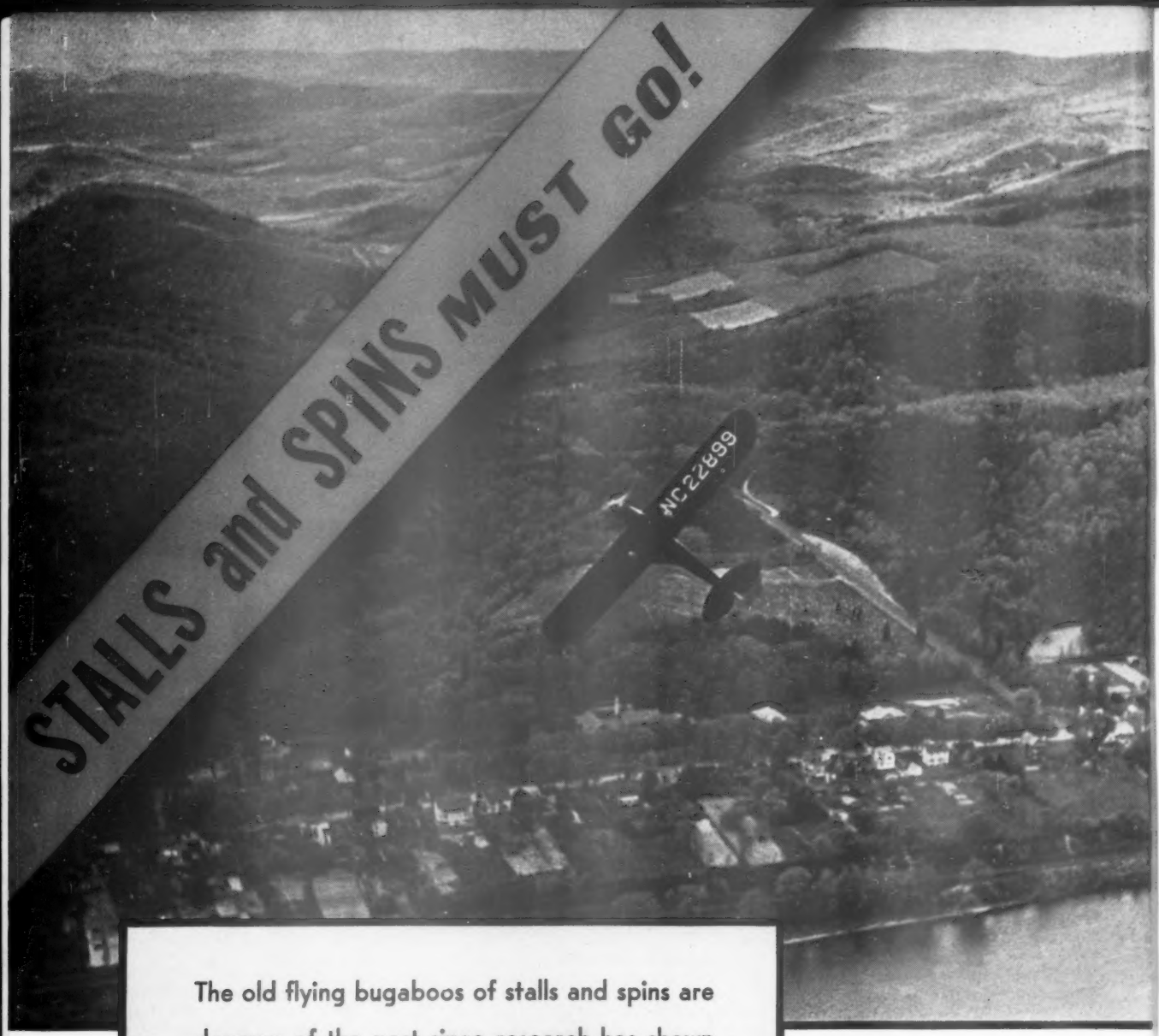
(*Continued on page 72*)

Staple Italian fighter is Fiat CR-32. Its 550 h.p. engine gives it a top speed of 242 m.p.h. Range is only 527 miles. Armament: two guns.

Gradually replacing CR-32 is Fiat CR-42. Its 840 h.p. radial engine makes its top speed 272 m.p.h. It has two guns.



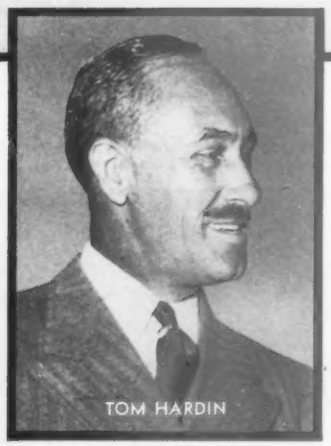
STALLS and SPINS MUST GO!



The old flying bugaboos of stalls and spins are dangers of the past since research has shown they are overcome by improved airfoil design.

By TOM HARDIN

Elimination of basic faults in airplane design prevents the dangerous stall that might otherwise be threatening this pilot as he pulls his ship's nose up abruptly.


TOM HARDIN

"HE spun in" or "He stalled and dived to the ground" describes the fate of the majority of pilots who have lost their lives in aviation. For many years the spin and stall characteristics of airplanes mystified engineers and pilots alike. Their only correction was found in avoidance which was accomplished by the pilot always maintaining ample flying speed.

"Keep the nose down" became the aviator's life-preserving axiom. It was on the lips of every instructor; was thoroughly imbedded in the minds of every student. Not until in the second decade of flying was it found that recovery from a spin was possible; that although the nose was down when an airplane was spinning, controls had to be pushed forward instead of pulled back as the first step toward regaining control.

This method of overcoming the death-dealing spin, however, merely resulted in the development of piloting technique and *did not correct the basic fault* which continued to exist in airplane design. Neither did it result in appreciably cutting down fatalities resulting from the action of inexperienced pilots and even experienced pilots who found themselves in the clutches of a spin or stall without sufficient altitude for recovery.

Fixed type slots have been built into the leading edges of the wings on this Stinson "105". They give better control at slower speeds, preventing the dangerous characteristic in which a stall starts at the wing tips, then covers the ailerons.

For many years engineers were mystified as to the design elements fundamentally responsible for different spin and stall characteristics of airplanes. Changes in design introduced new factors into the problem. About a dozen years ago the nemesis of designers was the flat spin, a spin that defied the skill of pilots to effect recovery. A few recoveries were made from spins of this nature by breaking the gyrations with periodic accelerations of the engine in combination with certain control manipulation. This solution, however, was not satisfactory because required manipulations apparently varied according to conditions and different planes and pilots were not always able to execute the proper combination of maneuvers to effect recovery. Furthermore, these recoveries were made only after a tremendous loss of altitude. Other incidents have occurred in which the airplane automatically recovered from the spin after the pilot had jumped. In more than one instance the plane recovered from the spin and started to dive when the pilot shifted the center of gravity by throwing the weight of his body forward preparatory to leaving via his parachute.

Every aeronautical research agency in the country concentrated on the solution of the flat spin problem. The studies disclosed that distribution of weight and the relative arrangement of airfoil surfaces were the chief factors concerned in the flat spin. Subsequent designing nearly eliminated the possibility of building airplanes that would show flat spin characteristics during the initial flight test.

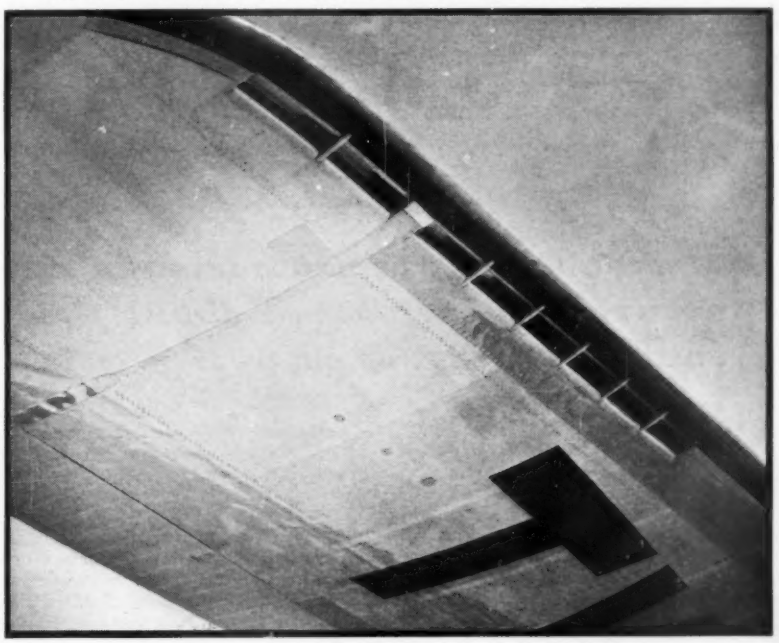
The most recent spin problem faced by engineers has developed with the design and use of highly tapered wings. This design has introduced a dangerous stall characteristic in which the stall starts near the tip and quickly envelopes the aileron control surfaces. Movement of the ailerons in an attempt at recovery only aggravates the stall. The wing drops violently, thereby causing an increased angle of attack which makes the stall spread immediately over the whole wing. Practically no warning is given the pilot and once the stall starts he is helpless until he can reduce the angle of attack of the entire airplane by diving. The situation is made more complex if the plane readily spins. In either instance, considerable altitude is lost before recovery is effected.

Conditions responsible for this type of stall have been counteracted to some extent by the use of slots and by warping the wing so that the root section of the wing stalls first causing the tail to buffet and give warning to the pilot prior to the time the stall results in complete loss of control. Other methods have been employed to counteract the dangers of the tip stall such as spoilers and stall-warning devices, but these devices *off-set* rather than *correct* the basic error of design. The correction of poor stall characteristics by the use of improved airfoil designs already has been accomplished by the engineer of one small airplane and the possibility of this solution also has been indicated by several others.

Hall Hibbard, chief engineer and vice president of the Lockheed Aircraft Corporation, expressed his opinion relative to the development of new stall-safe airfoil in his article which appeared in the April issue of POPULAR AVIATION. In describing the airplane he would design for family use, if called upon to do so, he said:

(*Continued on page* 66)

Close-up of the wing slots on a TWA Boeing "307". Without them movement of the ailerons in an attempt at recovery usually would tend to aggravate the stall.



Photographs of military objectives are made by reconnaissance planes before and after bombardment.

WHAT IS Reconnaissance?

By JAMES L. H. PECK

Modern warfare demands immediate, accurate information about the enemy. The flying observer gets it.

WE'RE hearing a lot about reconnaissance flights over the Siegfried Line and the British Isles these days. Most of the "offensive" aerial operations to date have been of this nature. The reason is the immediate necessity for knowledge of what the enemy is doing and where and how he's doing it. This branch might be aptly described as the "eyes of the intelligence", because the scouting and observation units are, perhaps, the most important original sources of enemy information. These data are something of which the high-commands cannot have too much.

Completely overlooking the value of the airplane as a combat arm, the early World War I high commands also underestimated its value in the only capacity which then justified its use in their opinion: detailed observation of all enemy troop movements.

All combat units, down to and including the infantry, are provided with Intelligence personnel. Air units of pursuit, attack, bombardment and observation—even units as small as the squadron—have one or more officers charged specifically with intelligence duties, who operate under the intelligence section of the staff and are known as "G-2".

Observation aviation, in contradistinction to the three other branches, often is employed to operate only with ground divisions and corps. In such cases, it is concerned with obtaining and disseminating only such enemy information as is required by the section to which it is assigned. This is not to say that Observation does not work with other aviation units, however. For example, it is frequently called upon to support attack and bombardment missions. Much of the information, especially

that concerning any moving objectives such as troops and supply convoys, is furnished attack units by observation using radio. During night missions, the observation ships may precede attack units along the route and, in addition to furnishing radio information, they may drop parachute flares to illuminate the objective. Observation functions in a similar manner when supporting the bombardment units.

Information desired by commanders of the other air branches and flying personnel varies with the function of the branch. The organization of infantry, operation of tanks, or hostile artillery emplacements are of little interest to a pursuit group assigned to the G. H. Q. Air Force, while this is vital to an observation unit assigned to a ground division.

Obviously, all and any enemy aerial activity is of vital concern.

Reconnaissance planes are slightly larger than pursuits and far less speedy. In fact, the observation craft are the slowest of all military airplanes—except, perhaps, the cargo or ambulance types. However, Observation is rarely in a hurry—only when being attacked by enemy planes. The "eyes of the intelligence" must see all and this could hardly be achieved while roaring along at 300 or 400 m.p.h. Two-seater monoplanes are in universal use. In addition to radio, reconnaissance types are equipped with aerial cameras. The observer in the rear cockpit is provided with a flexible machine gun for defensive purposes.

The term "reconnaissance" is obviously of French derivation. Although the British call their ships of this type "army-cooperation" planes and ours are known as observation craft, the work carried on is primarily that of reconnoitering—whatever they name it.

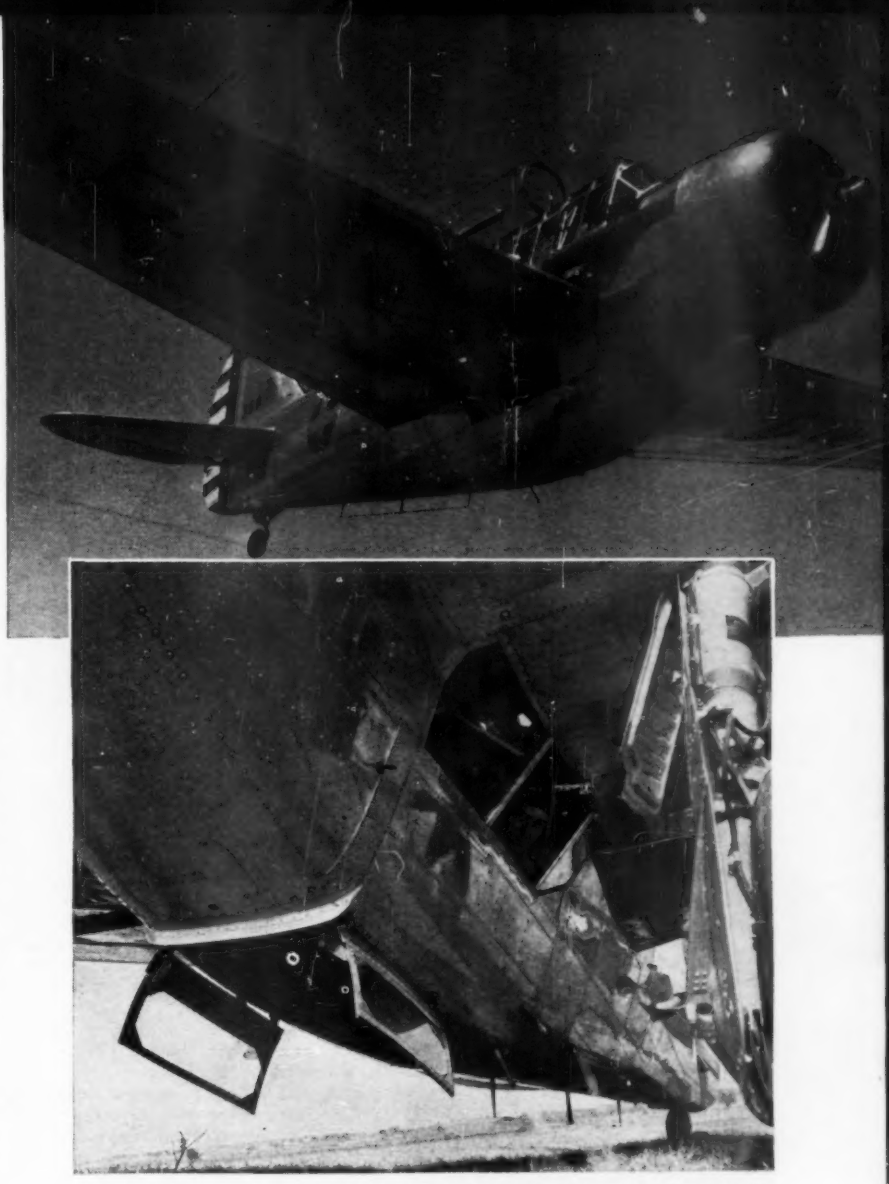
Autogiros are being tried by the U. S. Army Air Corps and the excellent hovering qualities of this craft afford both observer and camera an adequate "view" of enemy activity from low altitudes where the speed of the conventional plane would make perception difficult.

The enemy aerial operations and all information concerning them are necessary in order to determine his probable intentions and tactics. Other sources of G-2 supply information which often has to be verified by observation units. For example, G-2 might want this information concerning the enemy's bombardment unit:

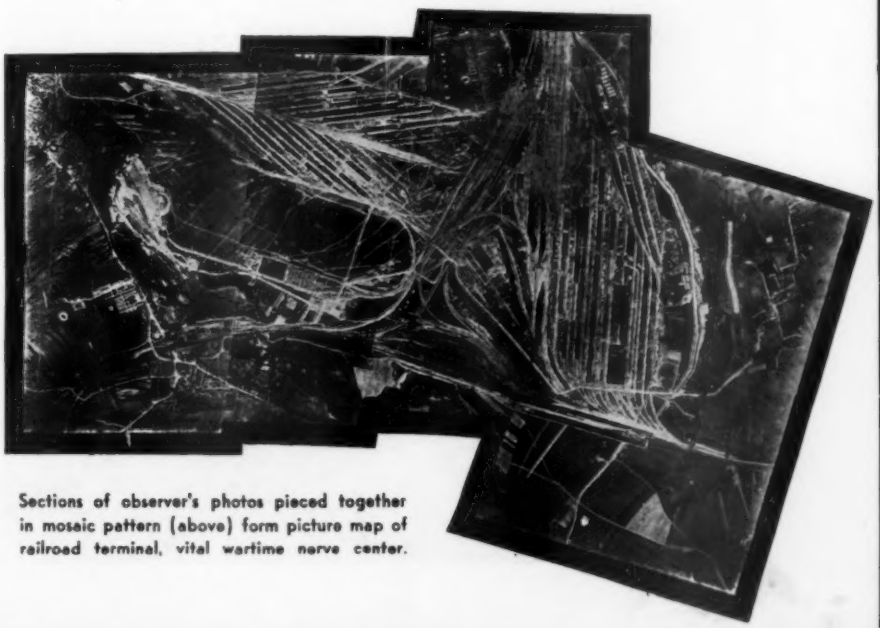
(1) Is it aggressive or cautious?
(2) Time of maximum concentrations.
(3) Size and type of formations.
(4) Methods of attack.
(5) Altitude proceeding to objective and at moment of attack.
(6) Pursuit support, if any.
(7) Size and type of bombs carried.
(8) Probable mission and objectives.

Such information may be reliably gained only by *air reconnaissance*—the work of aerial observers when they gather the data during flight. These missions of air reconnaissance are divided into six classifications:

Distant reconnaissance is for the purpose of supplying G-2 with any information



Typical American observation ship is the North American O-47A (top) standard U. S. Army and National Guard equipment. Directly above is belly camera port.



Sections of observer's photos pieced together in mosaic pattern (above) form picture map of railroad terminal, vital wartime nerve center.

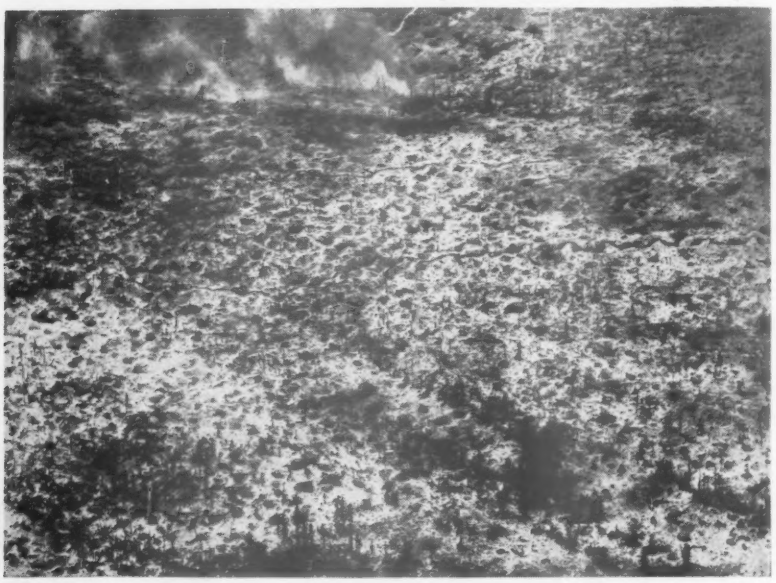
Observers checked what American guns did to Vaux, France, (above) in 1918.

Hovering qualities of Army autogiros (left) give pilots a good view of enemy.

of enemy activity and logistical establishments in the hostile rear. *Close reconnaissance* covers areas of tactical importance such as fortifications, barbed wire, trenches and artillery emplacements. *Battle reconnaissance* includes missions performed during hostilities such as infantry liaison and artillery adjustment or "spotting". *Command reconnaissance* consists only of special, impromptu missions which are of urgent nature. Usually, this is for verification of some recently received data. *Visual reconnaissance* and aerial photography are the methods by which missions are accomplished.

Personal reconnoitering depends upon the observer's ability to identify objects

Aerial reconnaissance includes (below) reports on the effect of artillery barrage.



quickly and positively, to make comprehensive notes and to memorize data which he may not have time to write. The airman's "seeing" is wholly a matter of interpretation and recognizing what he sees. This ability, though acquired only through training and constant practice, is necessarily dependent upon keen eyesight. He must know what a trench looks like from an altitude of 10,000 feet; how barbed wire appears from 5,000 feet; whether a road appears to have been well-traveled or not; whether the shell holes below are filled with troops, or water, or if they are empty; how the length and position of shadows indicate the depth and extent of fortifications, trenches or bridges.

How do these appear from the air? And how may trenches, for example, be identified as such by the observer? Certain terrain characteristics are common: Bodies of water have a characteristic appearance appreciably lighter or darker than the surrounding land, depending upon the amount of sunlight reflection. Swamps and marshy ground have a blurred appearance and are darker than the surrounding ground. Woods appear as dark masses of irregular outline, while orchards are recognizable by the regular spacing of the trees. Cultivated fields form geometrical patterns of varying shades. Tracks and trails across country usually appear as thin, light-colored lines while dirt roads are wider and straighter in trace. Railroads and highways describe straight lines and the easy curves, cuts, fills and clarity of outline give them away.

A certain amount of "detective work" is necessary to identify buildings of particular nature. In cities, school houses may be identified by the surrounding lawns and athletic fields; in the open country, by the absence of outhouses which surround most farm houses. Factories usually have tall chimneys nearby. Trenches are usually zigzagged or otherwise irregular and the shadows of the trench walls or the piles of dirt from their excavation label them to the airman. New works may be distinguished from the older by the lighter shade of the fresh spoil piles. Trenches in use are more distinct in outline than deserted ones. Barbed wire entanglements show up as a ribbon of varying shades of grey, depending upon their age. Also, the tracks of the working parties that laid the wire may be seen along either side. Machine gun emplacements and hidden artillery, while extremely difficult to spot unless the observer knows just where to look, are sometimes given away by the maze of tracks leading to them. Sometimes a pole-line of telephone wire will lead the observer to these concealed objectives and the lines themselves may be identified by their appearance as a series of regularly spaced dots connected by a thin line. Yes, the aerial observer soon becomes a fine military detective, among other things.

This "seeing" is only a part of his job; a job that is at once specialized and general. The observer must be pro-

(*Continued on page* 80)

AGILE AMPHIBIAN

This Grumman G-21 poses a pretty picture as it banks away from the camera plane high in the clouds.

FLIGHT BY NIGHT

This flashlight photo of a night-flying Army ship was taken from a camera plane.

by LIEUT. BYRON SMITH

There is something about flying in the dark night air that leaves an indelible impression even on hardened flyers. A pilot explains it.

I SIT in the cockpit of an Army basic training airplane. Around me, the darkness of a Texas night. It is a moonless night but the skies are clear and thousands of stars are in the heavens. I gaze at the instrument panel in front of me, turn the rheostat just a little brighter as I carefully check each instrument. I reach to the left of the panel and give each landing light switch a flip to make certain each light is functioning properly. Also, to insure that I will know where to put my hand if I should need my landing lights.

This night flying had seemed so simple when I received my instructions in the flight room not less than an hour ago. But now I begin to wonder and a certain amount of uncertainty comes over me. I quickly review these instructions in my mind. The field is divided into four zones by a cross of blinker lights on the ground. All I have to do is stay within one of these zones until I get my signal to come in for a landing. I look toward the hangar on which are mounted the various visual light signals —signals that may be used instead of the radio. The red circle of lights—do not land; the green circle of lights—to be used only if a visiting airplane comes to Randolph and desires to land. If either of these circles come on, I must stay in my zone. The signal for the various zones to come in for a landing will be the four bars of lights. These four strips of lights can be turned on one or more strips at a time. One strip to signal Zone 1, two for Zone 2 and so on. When my zone signal blinks off and on, I will be through for the night and must taxi in to the ramp. Well, if my memory holds, I should not tie up my signals.

My instructor has stepped out of the rear cockpit and I am alone in what seems to be an eternal blackness. I pick up the mike and press the button: "539 calling the control tower."

"Control tower to 539. Go ahead."

"Cadet Smith in 539 requests permission to take off for Zone 1."

"O.K. 539. Taxi out and take off after the airplane that is just landing."

I taxi to the edge of the ramp and, after a minute that seems an hour, the field is mine. I start to taxi to the take-off position. A red light hits my eyes. The control tower has stopped me with the red spotlight. An airplane with engine trouble is coming in for an emergency landing and now is making its

approach into the field. My heart skips a beat. What would I do if I should have a forced landing? I feel to the right of my seat to make doubly certain that I know where to reach the parachute flare releases. My engine doesn't sound as smooth as when my instructor was in the back seat. It seems to be loading up and I can feel a slight periodic thump. Now the tower shines the green spot on me which means that the field is clear and it is okay to take off.

I taxi into place, settle back in my seat, pick out a boundary light straight ahead and give my airplane the gun. I seem to be surging forward at a terrific pace and I can't help but feel that I should have cleared the ground hundreds of yards back. I hit a small mound and I feel that I have bounced 50 feet in the air. I am sure the field never was this rough and I should know. After all, haven't I taken off and landed on this field for the past four weeks? Haven't I had almost 25 hours of daylight flying since my arrival at Randolph Field? My wheels leave the ground but I don't appear to be climbing very fast; the boundary lights draw closer. I glance at my altimeter and see that I have 200 feet, but just the same the ground appears to be awfully near, even though it is a relief to know that I have cleared the field. My look at the altimeter has temporarily blinded me and I realize that I have committed the blunder that my last minute instructions warned me of—lights in cockpit too bright. I slowly turn the rheostat down.

Two minutes later I am cruising in Zone 1. I bathe my eyes in the friendly lights of San Antonio. I feel a little smug as I think of the thousands of people who have never had the privilege of witnessing this rare and beautiful view of a city at night. To the right I see a smaller square of lights. Unimpressive as this Texas city would be in the daytime, tonight it is a beacon of life and imparts to me the feeling that I still am a part of the life below in spite of the blackness of the night about me.

I look to the north where in the daytime is a wide expanse of mesquite but tonight there is just blackness. Ground and sky seem like one. As I fly north even the most shallow banks feel steep. I suddenly realize that the lights of Randolph and San Antonio and the few scattered ones moving along the highway below are my extreme friends.

I turn and fly south. As I approach the south end of my zone I study the lights of Randolph Field. The revolving beacon, mounted on the top of the headquarters tower, casts its split beam across the heavens as it rotates round and round. Strange that I have not noticed it before now, because one of my mental notes was to get a good look at this beam and its identifying split that tells all pilots that here is an Army landing field. I see the line of red boundary lights with, here and there, a series of green ones interspaced to define the landing lanes. A cheerful sight, this huge field below me.

"Zone 1. Come in for a floodlight landing."

Well, it is now or never; that is my signal. The descent to the 500-foot level seems to take hours, yet my airplane appears to be almost diving. I make my last turn into the field and settle back for my first solo night landing. The stream of light from the floodlights looks like a narrow ribbon. I put on 20° of flap and lower my nose. The strip of light grows wider. My radio blares forth: "Increase your glide, you are coming in too slow." I do so and wait five seconds, 10 seconds, then slowly pull back on the stick. "Bring her down to the ground; you are too high." I do so, my wheels touch and I know that I can do it! . . .

Two nights later I report to the line for my second period of night flying. Tonight I find that I must be even more on the alert than during my first night, because tonight the airplanes will be "stacked" two deep in the zones. That is, each zone will be divided into a lower and an upper zone. The airplane in the lower zone will use altitudes between 1,000 and 1,500 feet while the one in the upper zone will use altitudes from 2,000 to 2,500 feet. The night is equally as black as the preceding one but this time I have the self-assurance that comes with having done something before. I take off for Lower Zone 1.

I spend the first half-hour of my period on a review of my previous night's work. I am able to get in three floodlight landings during the half-hour and, if I do say so myself, that last one wasn't half bad. Suddenly the night seems to be much darker. I look toward the field and see that the floodlights have been turned off. We are ready to start the second phase of night landings: landing in the dark with only the landing lights, mounted in the wings of the airplane, to light up the ground.

My bar signal goes on and I start my descent for my first landing with wing lights. The ground looks awfully black and I begin to wonder if the two lights in the wings will be able to light up the ground. My problem is answered in a very short space of time. I turn my lights on at 200 feet and all that I see is a stream of light cutting the blackness in front of me. I am still too high for

(*Continued on page* 84)

"I taxi to the edge of the ramp and, after a minute that seems an hour, the field is mine. I move into place, pick out a light straight ahead and give her the gun."

PILOTS FROM AN EARTHQUAKE

by MARVIN C. LUPTON

Helena High School's flying cadets built their plant from salvaged material and scrap iron. Students learn crafts, earn their wings in two-year course.

LAURELS for true pioneering in the field of academic aviation well might be awarded to Helena High School of Helena, Mont. For years, prior to the incubation of the Federal Government's huge college training program, Helena High was turning out aviators and skilled mechanics. Annually since 1935 a full 40 per cent of the school's students have found their way into the various branches of aeronautics.

Today the school lists 165 graduates. Of this number 68 have found places with Boeing Aircraft in Seattle, 18 are with Lockheed in California and 39 others are on the payrolls of other Pacific Coast plants. Twelve are either commissioned officers or flying cadets in the Army, while the Navy claims two as commissioned officers and six as Naval aviation cadets.

The origin of the school at a time when aviation for high schools was an unthought of deviation from Hoyle, is more or less dramatically mixed up with the earthquake which wrecked the town in October, 1935. Aviation as a study was first begun at the school in 1933, but it was not until after the quake that great strides were made. With its new $500,000 school building lain in a smouldering heap by the quakes after only 34 days occupancy, Helena launched revolutionary measures to care for the students of the city. Aviation was given its chance on a scale unprecedented among schools of the nation.

Landon W. Fahrner, who had taken over the aviation classes in 1931, requested that he be allowed to take his 37 boys to the city hangar for specialized training during the hectic period of stress and reconstruction following the catastrophe. The school board sanctioned the idea. So for two years, while more than a thousand students of the district jammed the two dozen railway coaches provided for class sessions, the 37 youngsters under Fahrner's tutelage met at the municipal hangar for their lessons in aeronautics. While their brothers and sisters worried over grammar and Latin assignments in their improvised classrooms, the flying cadets concentrated on such subjects as internal combustion, engine maintenance, aerodynamics and theories of flight.

At the airport Fahrner turned over his own plane to the use of his charges. He taught them to fly, to overhaul planes, weld and construct new parts. Little by little they developed into craftsmen. So phenomenal was the success of the new idea under Fahrner that, in the fall of 1936, the school board voted to continue the aeronautical division as a special department. They alloted $7,500 for the construction of quarters.

It was not as much as Fahrner had hoped for. He pondered the situation and subsequently called a meeting of the boys. Present was Perry G. Means,

L. W. Fahrner

engineer in charge of the huge reconstruction program for the school system. A working plan was drafted—a plan by which the money would, by cooperative participation on the parts of the boys, be stretched to the very limit. Means, in a rapid survey of the earthquake damage, made careful note of all the salvagable material left in the demolished school buildings. The possibilities were unlimited. Huge timbers, sheeting, plumbing fixtures were to be had for the taking. Doors and windows were easily available. A local engineering plant contributed more than two carloads of scrap steel which was subsequently straightened, welded and used in the structural frame of the new plant.

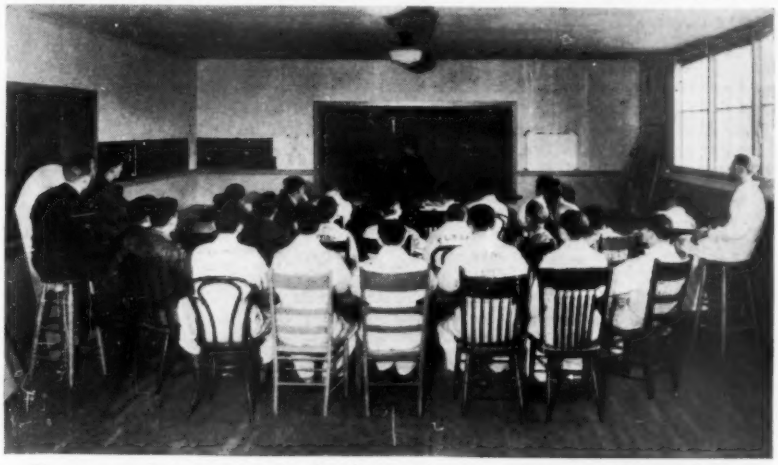
Then, organizing into crews, the boys poured cement, salvaged and hauled materials, hoisted the girders into place, laid sheet metal and aided in the wood working. Residents and merchants of the town co-operated wholeheartedly. After months of work that lasted well into the spring of 1937, the building was completed. Today it is insured for $30,000, exclusive of planes and equipment. The structure contains 10,000 square feet of floor space. A new addition, now under construction, will supply 24,000 square feet additional.

During the past four years the school has operated virtually apart from school district aid. The whole project has set the administration back less than $28,000, a startingly small sum in view of the magnitude of the program. More than $15,000 worth of tools and equipment have been added to the original supply, independent of district allotment. The plant has become widely known in the Northwest as a "plane clinic" and dozens of Government ships, as well as those of aviators from all parts of Idaho, Wyoming and Montana, receive repair and maintenance work there. The proceeds from the sundry jobs are turned back to the school for the purchase of supplies and for general plant improvement. The repair work is done exclusively by advanced or senior students under the supervision of licensed personnel. The equipment of the school is complete, enabling the young mechanics to handle any repair or overhaul job to the satisfaction of Government inspectors.

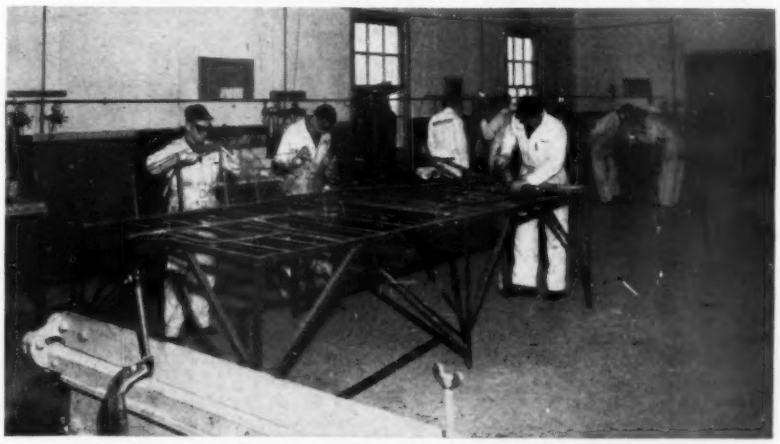
Due to the income of the institution, the cost per student is substantially less than for those enrolled in regular courses. Another financial aid to the school is the cooperation of the Federal Government in paying one-half the instructor's salary through funds made possible by the George Deen and Smith-Hughes foundations.

Flight training of the Helena student is patterned after that employed by the Army training schools. Sixteen hours

Fuselage overhaul jobs are part of the curriculum in Helena High School's aviation department. Advanced students do regular maintenance work for private airplane owners.



Classroom work is important to the flying cadets as well as their flight and shop training. Senior students learn the mathematics of construction and flight theories.



For 12 weeks the cadet receives an intensive course of instruction in a welding shop. At its conclusion he is qualified to work on licensed airplanes anywhere.

From all over the Northwest airplanes come to the Helena high school's shop for repairs. Advanced students expertly complete an overhaul job on a C.A.A. Waco.

of dual instruction is given the student before he is allowed to solo. He must show skill in executing spot landings, turns and spirals to spot landings. He must be thoroughly able to consistently pull his ship out of a stall, execute precision spins, wingovers, vertical turns and figure eights.

Students receive weekly two half-hour periods of flying instruction until the end of the school term. Flying is begun in early September and terminated in November until the following spring. A total of 131 cadets at Helena high have "won their wings" since 1935.

During the past five years the school has acquired a total of 22 planes. Nineteen of these are unlicensed craft, having been purchased cheaply or salvaged from wreckage. They are used for engine room and experimental work only. The largest of these latter planes is a Fairchild "71"; the smallest an Aeronca C-3. For flying purposes the school owns two Fleet biplanes. One is used for solo flights; the other, equipped with dual controls, serves as the "battle wagon" for beginners. All dual flight is handled by Fahrner. The third licensed machine at the school is owned by R. E. Morrison, Helena commercial flyer. It is an Aeronca *Chief*. Morrison, a former flying partner of Fahrner, has aided the school materially by virtually turning over his plane to the use of advanced solo students. Four highly-trained and licensed assistants to Fahrner complete the instruction personnel of the school. All practice work is done under the close supervision of the staff. Repairs are made under specifications as given by the C.A.A.

The aeronautics course consists of two years of applied work. Those who have acquired junior standing alone are eligible. The group personnel is established through a highly selective registration system. Candidates are judged by character, initiative, ability, mechanical inclination and past successes.

After weeks of concentrated work on wing construction and fabrication, the first-year student at Helena high takes up welding. His practice with the torch extends over a period of 12 weeks during first year, 18 weeks during the second. This course is somewhat longer than that given in schools for adults, but the added time is put on in view of the fact that the high school students are usually entirely inexperienced. Each student who successfully completes his welding course is eligible for that work on licensed aircraft.

Helena students, after their first year's work, are expected to turn out lathe work comparable to jobs in the industry. The school is equipped with the most modern equipment available for this type of instruction. Next the student is transferred to the engine room where many kinds of aircraft engines are to be found. During his 18 weeks additional during the second year here, he is expected to disassemble and assemble all types of motors until he has reached a high degree of proficiency. A thorough study of magneto and carburetion follows.

The spice of the training, which sets Helena High apart from other vocational high schools of the nation, is the actual practice in flight. After one semester of ground work the student is allowed dual instruction from Fahrner. The Helena students during the past five years have flown more than 3,000 hours without so much as having scratched a plane.

Previously, classes have been limited to 45 students. Increased space, however, will see the capacity set at 70. Helena is proud of her experiment and widespread interest is being shown in many parts of the country concerning the school. C. L. Egtvedt, president of Boeing Aircraft, said:

"We are delighted with the quality of work turned out by the graduates of the Helena institution. The nation needs more such schools."

Said Clinton M. Hester, administrator of the Civil Aeronautics Authority at Washington:

"I am proud that my home state has established this unique institution. Montana is showing the way toward high school aviation."

END

Pioneer Flivver

A FAR cry from the sleek Piper *Cub*, Taylorcraft, Fairchild or other lightplanes of today that the youth of the nation nonchalantly scoot about in now, was one of the granddaddies of the modern lightplane.

The granddaddy in question was a jallopy built by two Beloit, Wis., Early Birds, one who foreswore flying after his experience with the initial plane and the other who became so intrigued that he became a wartime instructor.

For about 20 years now, T. L. Timmons has been on the police department in Beloit and the nearest he has come to flying in that time is to zoom out in a squad car. But back in the old days it was another story. Timmons and a fellow mechanic were employed at the old Warner Instrument Co., manufacturers of the first automobile speedometer. Both he and his friend were interested in motorcycles and motorcycle racing, about the most daring sport of the day.

Because of his fame as a motorcycle racer, Timmons and another Beloit man were invited to race their steeds at the old South Beloit track against a barnstorming pilot, Jimmy Ward. Needless to say, the airplane won the race and Timmons became interested in planes.

After the race, Timmons talked with Ward, learned a little something about the rudimentary plane and then went to mull things over with his mechanic crony, Trenton Fry. The two decided to build their own plane with the information Ward had given them as their only guide.

That was back in 1913. The pair purchased a second-hand, 50 h.p. twin cycle Roberts engine and started laboring on their single-seater craft. Throughout the summer and fall they toiled and into 1914 before the astounded neighbors saw them one day wheel out a strange looking product. The masterpiece was finished. The biplane had a wingspread of 27 feet and was 25 feet long. It was, they hoped, ready for testhopping.

Fry and Timmons carted the craft to a farm south of the city. But the plane (weight only 700 pounds) wobbled all over the field in high winds and weather kept it grounded for several days. Came a lull in the wind one fine summer day and the fledgling pilots made ready for the first take-off. Into the ship crawled one. The motor was tuned up, the throttle opened and away she went—but not far. The plane veered toward a parked motorcycle and the prop hit the machine. The prop was shattered, so flight was delayed until a new propeller was obtained.

Again the machine was ready for flight. Said Timmons:

"I hadn't much idea how to fly but I climbed in."

The throttle was opened, the propeller bit the air and the ship jumped down the rough field like a scared jackrabbit. Then suddenly up into the air it lum-

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John Hinson dodged boat masts to land his ski-equipped Cub on an ice-choked Chesapeake Bay cove.

Flivver to the Rescue

By ALMA HEFLIN

A blizzard brought aviation to Maryland's East Shore islands with an icy cove for an airport.

ALONG the eastern shore of Maryland, where the Chesapeake Bay cuts up into the heart of the state, there are some little islands that almost are a country apart. Making their living by fishing and quite self-sufficient except in unusual emergencies the people, who are only 15 or 20 miles from the mainland, have clung to old customs, intermarried among their own people and live in the homes their grandfathers built. Their two-way radio telephone—a recent acquisition—is their latest and almost their only concession to the restless urge of the rest of the country for constant communication.

But Smith Island—one of those typical of all the rest—has started a move toward building an airport, possibly even toward a community-owned airplane, much as others sometimes own rescue boats in common or as most towns own fire engines. Every one of its people is to be taken for a flight next summer and the schoolground is to be enlarged to serve as a runway. Smith Island has become aviation minded and the selling was packed with enough suspense and drama to make a Hollywood mogul yell for a script writer and cameraman.

The blizzard and freeze that was back of the development wrapped its white smother over the off-shore islands back in mid-January. At first no one took it very seriously. For nearly two weeks, while the ice became thicker in its throttling hold on the bay, the islanders lived comfortably in their self-sufficient little world. Then they began to worry. Their first call for help went out by radio-telephone at 10 o'clock one morning and Coast Guard planes roared out on the heels of a snow flurry to check on the situation.

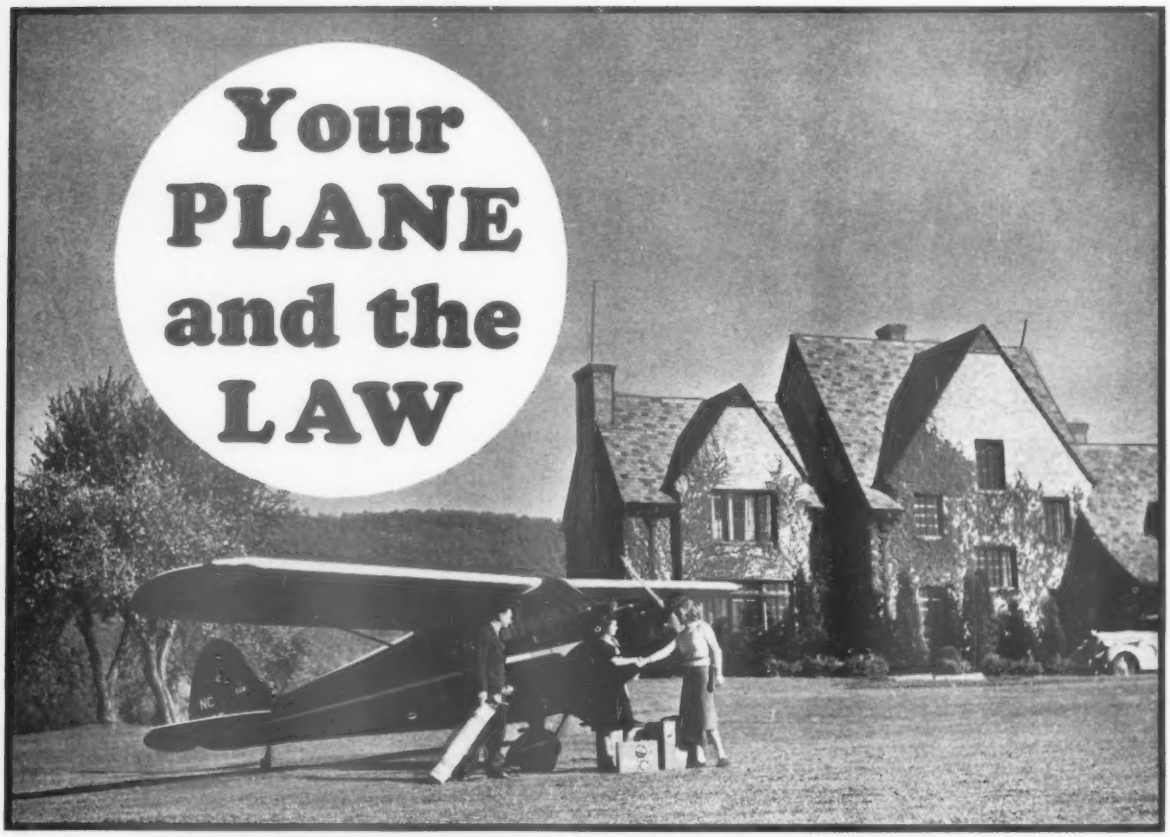
Freezes and breakups, followed by more freezing, had left the surface of the bay buckled and ragged with ice floes frozen solidly together. At best, a hundred feet here and there was all the clear space to be found on the ice.

(*Continued on page 62*)

Fred Ennis gets ready to take off from Salisbury with milk and medicines for icebound children.

Smith Island (below) is building a runway near its high school, hoping to buy its own airplane.

Your PLANE and the LAW



Flyers should exercise caution in landing aircraft on private grounds. Permission should be obtained first.

By HILL EDWARDS

Few pilots realize their legal responsibilities while flying. Herewith a few valuable tips.

ONE evening not long ago a friend of mine—he operates a small flying service, giving flight instruction, renting two or three lightplanes and doing charter work—dropped by the house to tell me about a forced landing. A clogged feed line had sent him down into a farmer's garden patch. He cut a pair of furrows through radishes and onions, ended when his propellor chewed up a clothes line carrying a couple of aprons, some wash dresses and the farmer's other pair of blue jeans.

The farmer and his wife had the law on their side and they knew it. Go back into British jurisprudence and you find that anyone who keeps anything admittedly dangerous assumes full responsibility for what it does. In those days it might have been a vicious animal or even a reservoir. Today, it's an airplane, too.

The farmer and his wife demanded a settlement then and there. My friend explained about his clogged gas line and the inexorability of the law of gravity, but this didn't do much good.

"Makes no difference!" shouted Old Hi. "I'll have the law on ye. Ye've no right to come trespassin' on my prop'ty. What's yer name, young feller, and where do ye live?"

That started an argument over the length of time it would take the farmer to repair his garden, the cost of repairing and replacing the garments damaged and how long it would be before the hens started laying again.

"So I settled," said my friend, "for $10. They seemed satisfied."

"Of course," I suggested, "when you paid off you got a signed release from liability."

No, he hadn't asked for one. And because he didn't get it *he was still liable* if the farmer and his wife took a notion to sue. I explained to him that I'd been investigating aviation law from attorneys I know and that I'd discovered it was better to play safe.

If you know your law you recall that there was another forced landing much the same as that described by my friend, made by another flyer more than 100 years ago. His landing resulted in the first lawsuit ever filed involving aviation. No, it wasn't an airplane. It was a balloon. The landing took place in New York in 1822 and the final decision on the complaint was handed down by the Supreme Court of that state. The balloonist came down in a farmer's garden. The farmer sued and collected $90 in damages, not only for the injury done by the flyer and his balloon but by a large crowd which had gathered to see the excitement. And the curious part of it is that the old judge who decided it set a precedent which has been followed by the courts ever since. He ruled that the balloonist was a trespasser, just as the farmer said my friend was, and that any injury that was done to property, either directly or indirectly by reason of the trespass, would have to be paid for. Today, lawyers call this the "doctrine of absolute liability" which means that if an aviator, in making a landing without permission on another person's property, does any damage, he is absolutely responsible, *regardless of the cause of the landing.*

This is common law. In addition to this at the present time there is in effect

Landings like that in the parking lot of Chicago's stock yards above are subject to many legal ramifications.

in 22 states the Uniform Aeronautics Act, which says substantially the same thing in statutory form. I explained all this to my friend and now he carries around several blank forms of release which he bought for five cents apiece at a legal stationer's. He'll pay for no more damages unless the property owner signs up.

The average lawyer is not anxious to write any kind of an article about aviation law, telling you what you can or cannot do with an airplane whether you own it, rent it from someone, or rent it to someone. There's a reason for this. At present there are few appellate decisions written on suits resulting from the operation of aircraft. It's safe to guess that more than 500,000 appellate decisions involving automobile accidents have been written and are available for study. But all of the decisions handed down on aircraft accidents can be found in 12 small volumes which in no sense cover the field of operations accidents. It's not only possible but quite probable that if you have any kind of an accident which results in a lawsuit which gets to the appellate court for a written decision, your name will go down in history. You'll have done something new and therefore legally valuable—if that's any satisfaction to you.

However, lawyers do know certain things. For instance, not long ago a couple of friends of mine became involved in an accident which throws further light on what you can and cannot get away with. We'll call the pilot—he held a private rating—Scruggs. He rented a ship from an operator we'll call Jones. While going cross-country, Scruggs flew over a racetrack to see the ponies run. One of those aerial advertising outfits had a big sign strung out behind a Waco with a wind sock on the end of the line to keep it straight. The Waco was up about 1,000 feet and cruising just fast enough to hold elevation. Scruggs evidently saw a horse he knew, for he suddenly dived down to within 50 feet of the stables, zoomed upward and with his left wing clipped the wind sock which the Waco towed. He yanked the sign free from the Waco, tearing it to shreds. All he did was rip a small hole in the fabric of Jones' ship. Then, scared, he bee-lined back to the airport. Behind him came the irate owner and pilot of the Waco.

The Waco owner wanted $50 for damages. Scruggs said to Jones, the operator:

"I rented the ship from you. You're responsible, as owner. I'm not."

A suit followed. Scruggs and Jones were named co-defendants in the damage claim. The attorney for the owner of the Waco made Jones admit that he owned the ship. Then he proved that Scruggs had been flying under 1,000 feet over an assemblage of people. When the defending lawyer protested, the judge said:

"The mere breach of a regulation of the Civil Aeronautics Authority is negligence per se, if the breach is the proximate cause of a resulting injury."

Which means that all the plaintiff's attorney had to prove was that the pilot, Scruggs, had been guilty of a violation to collect damages from him. He was hooked. The judge said:

"Gentlemen, it will be the judgment of this court that Mr. Scruggs, the pilot, pay to the plaintiff the sum of $50, the value of the sign that was destroyed. But I'll hear argument by counsel on the legal responsibility of the owner of the ship."

The attorney for the Waco owner set forth that, inasmuch as Jones owned the ship, he was equally responsible with Scruggs. Jones' lawyer replied by reading Section Six of the Uniform State Law for Aeronautics, heretofore mentioned, as follows:

"Collision between aircraft. The liability of the owner of one aircraft to the owner of another aircraft, or to aeronauts or to passengers on either aircraft for damages caused by collision on land or in the air shall be determined by rules of law applicable to torts (any wrongful act) on land."

The attorney for Jones explained that this statute means that if there is a collision between two airplanes the responsibility shall be decided the same as if it was between two automobiles on the ground. If one operator be negligent,

he is responsible. If both be negligent, neither shall recover because both are in the wrong.

"But," the attorney argued, "it is established law that if I hire my automobile to somebody I'm not responsible for what he does when he's operating it. In some states they have a statute which avers that I am responsible, but in the absence of statute the owner is not responsible."

The lawyer went on to explain that the difference between a case where there's been a collision between two ships and where a ship does some injury to someone on the ground. He admitted that the owner, Jones, was absolutely responsible for injury done to things or persons on the ground, regardless of who was flying the ship. *Remember that one.* But, he argued, Jones was not responsible for what amounted to a collision between Jones' ship flown by Scruggs, and the Waco.

The judge agreed with this interpretation of the law. Jones was released from responsibility for Scrugg's negligence and Scruggs lost his ticket for six months for his breach of C.A.A. regulations as a result of a supplementary C.A.A. hearing.

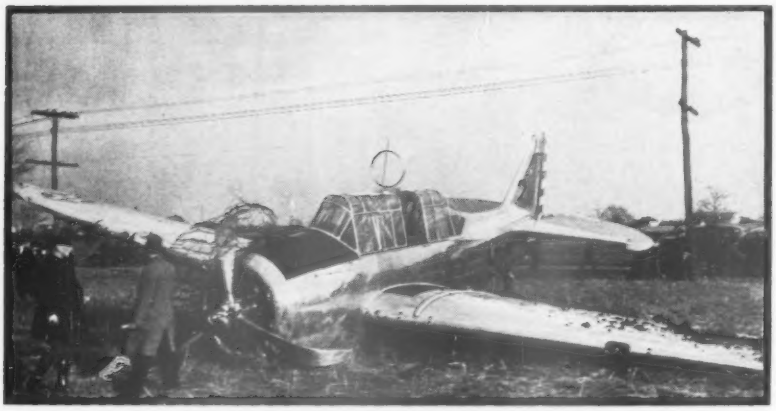
One point clarified is that Jones, had he been renting in some states, would have been jointly liable with Scruggs. He was lucky to be in the right state. You'll have to investigate to learn your liability as a plane owner in your own state. There are a lot of other points cleared up in that little case and it can be applied as a test case to situations which arise almost daily around your field.

My lawyer friends tell me that we who fly airplanes have absolutely no grounds for defense if we injure a person or his property on the ground with an airplane if the landing is made without the owner's permission. The owner of the plane is just as liable as the pilot, whether the plane has been rented or simply loaned. Let that come to your mind when a pal wants to try your ship "just around the field."

Not long ago a lad stacked his ship on top of an automobile parked in front of a nearby market while trying to land at an airport. If suit is brought, he can't offer any kind of a legal excuse which will relieve him of responsibility whatsoever. He can claim wind conditions, poor visibility, motor failure or anything he likes and it won't do him a bit of good.

Here is a landing on an airport, therefore permissive, which resulted in a suit. The attitude of the court toward such an accident is revealed in a decision handed down recently by the Court of Appeals in Maryland. In this case the question of absolute liability was not decided upon because the airport was regularly used for landings. Only the ordinary rules of negligence were involved. A boy was killed by an airplane while it was making a landing. The boy was crossing the field on a roadway, riding a bicycle.

The court said that the defendant could have overcome the claimed interference with his vision by fishtailing and by dipping his wings and that his failure to do so was negligence, for which he was responsible. The decision gives you some idea of the attitude of the courts. This decision will be applicable in future cases which result in lawsuits.



This National Guard plane made a forced landing on private property. Such landings, when damage has been done, are defenseless legally unless landing permission is gotten.

In the case of damage on land, the Uniform Aeronautics Act provides as follows:

"Section Six. Damage on land. The owner of every aircraft which is operated over the lands or waters of this state (the state being any in which the act has been adopted) is absolutely liable for injuries to persons on the land or waters beneath caused by the ascent, descent or flight of the aircraft or the dropping or falling of any object therefrom, whether such owner was negligent or not, unless the injury is caused in whole or in part by the negligence of the person injured, or of the owner or bailee of the property injured."

The last phrase indicates some hope for the owner or pilot until you stop to figure how anybody could be negligently hit by a falling airplane. That's hard to do, even with mirrors. About the only chance you would have to escape paying damages would be if the injured one had first written a suicide note and then had run into the path of your ship deliberately.

Supposing you take a friend for a ride and that friend is injured or killed either through some accident in the air or in contact with the ground. In general, the answer is that the liability of the owner of a private plane for the injury or death of his guests is determined by the ordinary rules of negligence or, in some states, by special statutory rules of liability. In general, the pilot of a private airplane is considered by the law to be in precisely the same legal position as the driver of an automobile. The Illinois Appellate Court held that in an action for the death of a passenger who was killed as the result of a mid-air collision the owner of the plane in which the plaintiff was riding was obligated to use only reasonable care to the end that the passenger might not be injured or killed. In other words, that friend who has been pestering you for a ride must assume the risks incidental to a pleasure flight and, in the absence of willful or wanton negligence, the host is not held responsible.

In the case of two airplanes colliding in the air over an airport or on the airport itself, responsibility for the crash will be fixed in accordance with the Civil Air Regulations and the airport regulations. The courts, as indicated by the tale of the jam Jones and Scruggs got into, have uniformly held that pilot guilty of the breach of regulations responsible.

The legal aftermath of a collision is complicated. There is a C.A.A. hearing to determine if the pilots should lose their licenses or have them suspended for having disobeyed the C.A.R. or the airport regulations. Then the civil actions start. In a recent case, even before a C.A.R. hearing against a pilot charged with breaches of C.A.R. and airport regulations, civil action was begun. The parents of a pilot killed by his airplane brought suits for damages against the pilot and the air service which employed him. The owner of the plane the pilot struck and damaged also sued both the pilot and the air service which employed him. The civil suits are still pending and the decision of the C.A.A. as to the pilot's competency has not yet been handed down.

Supposing you, a private, solo or student pilot, rent a ship. We know already that you are liable with the owner for damages to property and injury to persons in case of a forced landing. Can you collect damages for your injuries from the operator? Yes, providing the landing was *not* the result of a breach of the C.A.R. or negligence of some kind on your part—and you can prove negligence on the part of the operator who rented your ship to you. For instance, had he allowed you to take off without sufficient oil after assuring you the tank was full, you could sue him for any personal injuries you might have sustained in making your forced landing.

On the other hand, you assume liability. Recently a Los Angeles operator rented an airplane to a pilot who had a certificate of competency. Unbe-

(*Continued on page* 82)

Robert A. Winston

Finland vs. Russia

Uncensored Notes by ROBERT A. WINSTON

Editor's Note: Mr. Winston left the United States for Sweden several months ago as a representative of the Brewster Aeronautical Corporation, Long Island City, N. Y. He accompanied several of the Brewster fighters sold to Finland and was sent overseas to check out Finnish pilots in the American aircraft. A former Naval flying officer and instructor at Pensacola, Fla., Mr. Winston wrote several articles for POPULAR AVIATION *prior to his departure for Europe. He also is the author of a book, "Dive Bomber". He was born in Washington, Ind., on October 25, 1907. During his four years in the U. S. Navy (1935-1939) Mr. Winston served with fighting squadrons aboard three aircraft carriers. Assigned to Pensacola as a flight instructor, he taught instrument flying, dive-bombing, torpedo dropping, single-seater dog fighting and fixed machine gunnery. During this period he flew various aircraft, including the North American NJ-1, Boeing F4B-4, Great Lakes TG-2, Grumman F2F-1 and Douglas TBD-1.*

Genoa, Italy, May 3, 1940.

DEAR EDITOR:

Please forgive the stationery, but this is *rush*—last chance to get it on the *S. S. Manhattan* with one of our mechanics who is returning. I'm going on to Brussels, as the first of the Brewsters on the Belgian contract will be arriving there soon (barring accidents!).

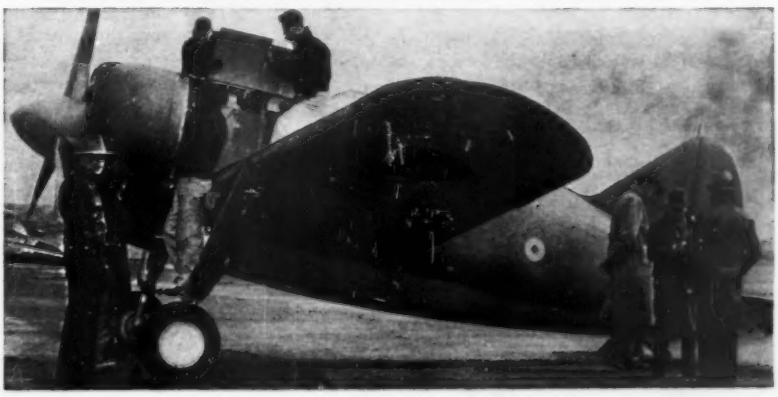
We finished our work for Finland about two weeks ago, but couldn't get out of Sweden except with a convoyed party through Germany. I got your cable to me, but couldn't wire back—things were too hot. They shot at two groups of our planes en route to Finland and shot down a couple of German bombers near Trollhattan. I made one flight to Finland myself —of which more later.

We left Tralleborg, Sweden, April 30 via sea-going ferry across the Baltic (four hours) to Sassnitz, Germany, on a German ship flying the Nazi flag. No mines or trouble of any kind. Those mines must all be on paper! We had no trouble of any kind getting through Germany—overnight in Berlin, again in Munich. Germany is just one big airport—flat sod fields from north to south. You can land anywhere. Passed several big aircraft factories—no attempt at camouflage, except mottled paint. Only planes I saw were very fast twin-motored bombers, several slow Junkers tri-motored transports and a few fighters in the dis-

(*Continued on page* 89)

Crated Brewster fighters stand on a New York pier (above) before being loaded on a Finnish freighter. Winston went to Finland to check out pilots in the Brewster "339" (below). He discovered many of the Finns had less than 100 hours in the air.

Finns in Fokker D-21's were superior to more modernly equipped Russian pilots.



TEST ENGINEER

by EDWARD CHURCHILL

Test engineer Harold Cheney studies the instruments from his seat in the rear of a Vultee "Valiant".

Test pilots are far too busy in today's high speed planes to answer all the engineering questions. So here's aviation's newest job.

ENTER the test engineer. His job is new and thrilling. He's a young man. A very few years ago his position didn't exist. Today, with aircraft manufacturing expanding by leaps and bounds, new jobs are being created overnight. His is one of these. In other days the test pilot, that daring young man at the controls of a prototype, made his performance report direct to the engineering department. In comes the test engineer, the skilled middleman with a technical and practical background, who takes part of the load off the shoulders of the test pilot.

The "why" of his job is simple. He's the go-between or liaison between engineering and flight operations at an aircraft factory. The test pilot has his hands full flying these modern jobs at speeds of from 200 to 300 m.p.h. and more, putting them through all the aerobatics in the book. The test engineering lad, quite as brave and bold as the man at the controls, gathers all technical information pertaining to the flying of the airplane, plans the tests to be made, develops flight recording data, inspects the results of the tests and then transfers his observations back to the project engineer, making recommendations concerning unsatisfactory items.

Every model gets a complete workout. Does the ship measure up to the preliminary performance data supplied by engineering? Does the cooling system function properly? Does the airplane fly normally? Is it stable? Does it have desirable stalling characteristics? Are the controls effective, as responsive as desired? Do the instruments do their jobs? Is the propeller set correctly? What is top speed? Is there any undesirable vibration and if so, why? Is it possible to do the required aerobatics? Is there buffeting due to flaps, poor filleting or other aerodynamic irregularities? Are the cockpits free from dangerous carbon monoxide gas? Those are some of the questions the test engineer answers as the pilot whips the ship around.

How would you go about getting such a job? What training do you need for it? What are the advantages and disadvantages? What salary can you expect? What personal characteristics do you need? To answer these questions, let's talk to Harold Cheney, chief flight test engineer of Vultee Aircraft. He's typical. He watched the new profession open up, stepped in, made good—without even a letter of introduction.

Cheney looks up from his desk in a small, temporary office, made necessary by constant shifting of personnel due to expansion. Everything seems to be temporary these days in an aircraft factory. He's blonde, rather shy, looks even younger than he is—27. In response to a barrage of queries, he tells us:

"My first aerial view of California was from 18,500 feet on a clear day three years ago. Sitting on an improvised bucket seat in the unfinished fuselage of

a Vultee V1A, a nine-place low-wing job with a Cyclone G-5 in the nose, I kept my eyes on a potentiometer as Alan Russell, test pilot, pulled off the Vultee field at Downey. We ran the climb as a part of tests to determine the efficiency of the cooling system."

At that moment a new flight test engineer was born. Cheney was so busy checking the instrument that he was up there before he knew it. He looked out a window, saw most of Southern California underneath him, murmured:

"Boy, isn't that something!"

Then he went back to checking. You don't have much time, he says, for sightseeing on test flights. This was the beginning. During the past three years Cheney has flown as flight engineer on tests of all models built at the Vultee factory save the recently completed *Vanguard* pursuit. There wasn't room for him in that, so he turned inventor. He developed a "tell-tale" device which is a complete set of test instruments housed in a box with an automatically operated camera facing them. This put him in the ship in spirit if not in fact.

This "photographic observer" takes pictures as fast as the pilot pulls a trigger, giving a complete record of his flight. It makes things easier for him. Tricks like this make a test engineer valuable and, if you can "dream them up", you will win a lot of favor with your superiors.

Among the ships flight tested with Cheney at the instruments have been the Turkish attack bomber, known as the V11-GBT, the Brazilian attack bomber (V11-GB2), the new V-12 attack bomber; the *Valiant* "51", a basic combat two-place job with 600 h.p. in the nose and a 230 m.p.h. top; and the *Valiant* "54-A", prototype of the Army BT-13, the first of which is just coming off the production line.

Cheney reports that his experience shows you'll be slowed down and your mind may get a little foggy from lack of oxygen. You'll be cold. You'll be uncomfortable because cockpits are not built to accommodate special test equipment. You'll wear a parachute, usually over a business suit. Your safety belt will be fastened always. You'll have a knee-board strapped to your leg on which to record data. You'll have a stop watch on your wrist.

There is no room for a flying test engineer in a pursuit plane, so Cheney had to solve the problem. He invented a "photographic observer" to make the test flights.

On your test program—in addition to climb, level flight and glide—are quite a few maneuvers. Stalls, for instance, to determine how, when, and what would happen if the pilot stalled the airplane under various circumstances. Slow rolls to check the ailerons and rudder for effectiveness, load required and coordination. Loops and sharp verticals to check stall characteristics under accelerated conditions. Banks to left and right, rolling to one side and then the other for further check. Snap rolls as preliminary to spins, for a snap roll is a spin under power done along a horizontal axis. Sharp skids to check directional characteristics. Pushing the stick forward, then releasing, to see what happens. Finally pulling it hard backward. Merry little ride, eh?

If you should become a flight test engineer you'd find that testing is done on clear days. On rainy days (there really are very few in California) Cheney is busy compiling reports, planning future tests and tending to other details.

(*Continued on page* 58)

Cheney (left) explains how his automatic observer works to test pilot Vance Breese and engineer Richard Palmer (right).

Even before this fighter leaves the ground, Cheney carefully checks all flight instruments. His report has to be complete.

Coast to Coast for Fun

by Robert F. Davis

If you wanted to take a vacation and visit clients scattered over the nation, what would you do? This attorney flew his own airplane.

FOR years I dreamed of owning an airplane but, at 34—in the spring of 1939—the dream seemed further than ever from fulfillment. I was in a business (patent law) that justified considerable traveling but I had come to realize, I thought, that owning my own airplane would be unjustifiably expensive, learning to fly would be a long and tedious task requiring perfect health, eyesight and coordination—and the danger of flying seemed to be great.

In this state of mind I had an opportunity to take a trip from Tulsa to Galveston and back with Bill Green, an enthusiastic flyer and president of Engineering Laboratories, Inc. We went in his new Beechcraft and flew to Galveston in less than four hours' flying time.

Flying did not seem difficult or dangerous the way Bill did it and my enthusiasm returned. An article entitled "Flying Is Cheaper Than Driving" in POPULAR AVIATION (December, 1938) caught my eye and when the writer presented figures to show that he could fly as cheap as he could drive, I began to think seriously about aviation.

I returned to Washington and, with considerable doubt still in my mind at least, visited a local airport and arranged to take a few lessons. Much to my surprise after a relatively few hours of instruction, I found myself able to get off the ground and back again without really running any great danger of breaking my neck. By August I was ready for my private pilot's examination. Of course, on that day I made the worst landings and power turns that I had ever made, but the inspector was kind-hearted and apparently knew that even so poor a flyer was not likely to get into any serious trouble so he gave me my license.

I purchased a Stinson "105" in September and flew it back from Detroit after about an hour's instruction. The trip took 4½ hours and 22 gallons of gas which cost me roughly $5.25—and I had nothing to do except watch landmarks. Just a simple take-off at Stinson airport, a pleasant jaunt across Ohio, a stop at Pittsburgh for gas, another 1¾ hours watching the Allegheny mountains slide underneath and I was in Washington.

San Jacinto Mountain was no menace.

Mrs. Davis accompanied her husband on the cross-country business and pleasure trip.

October and November passed with trips to New York, Philadelphia and other places not very far away. Then came the big news. The Gulf Oil Company was sponsoring a lightplane cruise to Florida the first week of January. Oil and gasoline were to be furnished free and entertainment was provided. My wife agreed to try it. Dick Hosley, a friend, also agreed to go. The application was sent and the gasoline tickets and instructions arrived.

About this time we really got ambitious. Clients in Hollywood, Dallas and Tulsa wanted to see me and we evolved the plan of making the whole circuit and seeing the country en route. Dick agreed to return from Florida by train. With the stops necessary for business and the time we spent in Florida and sightseeing along the way, the trip would take five weeks.

The weather was fine until the day before the take-off from Washington—the skies darkened and a heavy snow began to fall. A day or two's delay seemed imminent but at the last minute the weather man relented and Saturday, December 30, dawned bright and fine. There were five or six inches of snow on the runways but even with a full tank of gas, three passengers, a radio and baggage the little ship was off the runway with only two or three hundred feet of run and we were quite comforable in the cabin. An hour later we had followed the Potomac River down to Indian Head, cut across Virginia to Richmond, and changed our course slightly to head for Raleigh, N. C. Another hour and we were following the railroad into Raleigh, the first scheduled overnight stop.

Short hops took us to Savannah on the second day and Orlando, Fla., the rendezvous point, on New Year's Day. A great welcome awaited us here including a barbecue, an initiation into the Flying Alligators and free sightseeing trips through Orlando and Winter Park which are two of the most beautiful tropical cities in America. There were about 700 light airplanes on the field at

The author flew his Stinson "105" 7,500 miles for a total cost of $150—including taxicab fares.

Orlando, all having reached there through heavy winter weather without any more serious accidents than a few cracked wing tips. Stories of forced landings in pig pens and cornfields and getting lost and ending back where they started and having so much head wind that even the snails crawled past, were the order of the day.

We skipped the trip to St. Petersburg and went directly to Miami, flying down the beach to avoid the swamps. Here we spent six glorious days on the beach and watching the air races. Leaving Miami on Tuesday, the 9th, in the afternoon, we flew to Ocala in northern Florida and arrived in time to see the famous Silver Springs. Next day we hopped by way of Tallahassee and Mobile to New Orleans, arriving relatively early in the afternoon. Two days in New Orleans visiting the French quarter, eating at Antoin's, Arnaud's, Tujacque's and the other famous French places, inspecting the St. Louis Cathedral, the old French gardens and visiting a few of the night clubs, and we were ready to leave. However, the weather was not too good so we postponed our departure for two more days and spent them hanging around the airport.

Finally the weather lifted and we flew to Dallas one day, El Paso the next, Phoenix the next and then on the last morning of our western trip into the Grand Central Airport at Los Angeles. On none of these days did we fly over about six hours and we were always in early in the afternoon.

Our friends at Hollywood, movie people, showed us a grand time and we saw the inside of several studios and film processing laboratories. At Warner Brothers we saw three different pictures being made. In between these things I managed to work four days with my clients. In the evenings we managed to see the Brown Derby, the Florentine Gardens and several other famous Hollywood places.

On Sunday, the 21st, we left Los Angeles, flew back as we had come through the pass north of San Jacinto Mountain, past Palm Springs and across the desert to Phoenix. It is difficult to realize that there could be so much barren unpopulated land as we saw in the course of the western part of our trip. The country under us was rugged and utterly devoid of population most of the way but there was practically always a place in sight where we could have landed in an emergency. There were many places, however, where we would have had lots of walking to do to get help afterwards.

Leaving Tucson, about 50 miles out we had to turn back. After a couple of hours in Tucson, however, we tried again, the fog had gone and we contin-

Guadalupe Pass was the biggest hurdle.

SPEED AND EXPENSE SUMMARY

		Miles	Time	Gas	Oil	Gas Cost	Oil Cost	Stor-age	Tax Ret.	Miscellaneous
Dec. 30	Alexandria to Raleigh	250	2'45"	..	..	...	...	...	...	Oil and gas furnished free by Gulf.
Dec. 31	*Raleigh to Savannah	310	4'00"	..	..	...	...	...	...	Record not possible.
Jan. 1	Savannah to Orlando	250	3'10"	..	..	...	...	...	...	
Jan. 3	Orlando to Miami	230	2'10"	..	..	...	...	...	...	20 hr. check and
Jan. 9	Miami to Ocala	300	3'15"	..	..	...	...	...	...	minor adjustments.
Jan. 10	Ocala to New Orleans	520	5'10"	28	5	$7.42	$1.90	...	...	Oil changed $7.00.
Jan. 14	*New Orleans to Dallas	460	6'05"	22	..	6.73	...	$1.50	$ .72	Batteries for radio
Jan. 15	Dallas to El Paso	580	6'05"	33	1	8.58	.35	1.25	1.32	$3.90.
Jan. 16	El Paso to Phoenix	380	4'10"	21	1	5.31	.35	1.50	1.05	
Jan. 17	Phoenix to Los Angeles	400	4'05"	20	5	5.92	1.75	4.00	...	20 hr. check $5.00.
Jan. 21	Los Angeles to Tucson	510	5'10"	28	1	6.93	.35	1.00	.85	
Jan. 22	Tucson to El Paso	270	2'40"	16	1	4.44	.35	2.50	.36	Brakes relined and
Jan. 24	El Paso to Dallas	580	6'00"	25	1	6.62	.35	...	1.00	elevator controls
Jan. 25	*Dallas to Tulsa	240	3'00"	16	4	4.16	1.40	8.00	...	checked $13.50.
Feb. 2	Tulsa to St. Louis	370	4'00"	25	1	6.57	.30	1.50	...	20 and 100 hr.
Feb. 3	St. Louis to Cincinnati	350	3'15"	19	1	4.98	.36	1.00	...	checks $4.50.
Feb. 4	Cincinnati to Alexandria	400	4'00"	21	1	4.81	.35	...	...	
	Total	6400								
	Total for which account was kept	5060	69'00"	272	18	$72.27	$7.81	$22.25	$5.30	$33.80
						6.38	Tax return			
						$66.97	Net gas cost			
	*Especially strong head wind					7.81	Oil cost			
Average miles per gallon		18.65				$74.78	Net for gas and oil			
Average cost per mile for gas and oil		$.0155				22.25	Hangar rent			
						33.90	Miscellaneous			
Average miles per hour		92.06				$130.99	Net Total			

Fares from airports to cities:

New Orleans	$1.50 cab for two
Dallas	.07 each
El Paso	1.50 cab for two
Phoenix	.50 each
Los Angeles	1.50 cab for two
Tucson	1.00 cab for two
Tulsa	1.00 cab for two
Cincinnati	1.00 cab for two

Approximate total for transportation to cities, including tips, $22.50.

A concise summary of the Davis ship's performance and costs is shown in this table.

ued uneventfully on into El Paso. At times during that day's flying the visibility seemed rather low but we had been used to seeing 30 to 40 miles in the clear western atmosphere and even though the visibility seemed to get rather low we were still able to see four or five miles. The sky was overcast, however, with gray clouds that looked like snow and we flew most of the day in fear of having to turn back and lose a day's progress.

At El Paso there was snow for the first time in 10 years and we were delayed a day on account of weather. The following morning we got off to an early start, climbed to a little over 8,500 feet to take advantage of a tail wind and passed over Guadalupe Pass which is around 5,500 feet high. Guadalupe Pass is the highest land that our route crossed.

From El Paso to Dallas we traveled about 600 miles in about 4½ hours with the help of a tail wind. It was getting colder all the time and we were glad that the trip was as short as it was. The next day we flew from Dallas to Tulsa and that day it was really cold. The temperature on the ground at Dallas was something like 4° below zero and it must have been 12° or 15° below in the air. The first hour went by all right, the ship functioned perfectly and we were not very cold. But during the second hour, although the ship continued to function as well as ever, the cold began to seep in and by the end of that hour we were really chilly. By the time we landed in Tulsa it took a half-hour around the hangar stove to thaw us out.

Still on schedule, we had arrived in Tulsa on the 25th. I worked here until Friday, February 2. During the afternoon of that day we flew to St. Louis. After an evening with friends in St. Louis, we hopped to Indianapolis the next morning, had lunch and, late that afternoon, went on down to Cincinnati for the night.

The next morning was Sunday, February 4, the day we were due back in Washington. We hopped to Clarksburg, W. Va., where we stopped for gas and then were off for our last hop toward home.

Counting a number of short side trips, we traveled around 7,500 miles in five weeks and saw almost half of the United States during the worst part of a very bad winter without a single near-accident and with only three days' delay because of weather. The cost of transportation, other than that borne by the Gulf Oil Company—and including hangar rent, inspections and taxi fares to and from towns—was only $150. Other expenses, of course, were only what we had chosen to make them. The average cruising speed figured ultra-conservatively by measuring the direct distances between the towns through which we passed and not taking into account the fact that quite often we flew out of our way to follow railroads and roads through bad country, was 92.6 m.p.h. This was in spite of very strong head winds on the days that we went from Raleigh to Savannah, New Orleans to Dallas, and Dallas to Tulsa. The effect of these head winds was nowhere near compensated by the tail wind that we had the one day that we came from El Paso to Dallas.

The cost of gas and oil was about 1.5 cents per mile. Figured on the same basis as the speed, we got a gasoline mileage of 18.65 miles per gallon. Hangar rents amounted to a little over $20 during the period from January 9 to February 4. Minor repairs, 20 hour checks and one 100 hour check cost a total of about $35. All this was counted in the $150, total expense of transportation.

We made a real vacation out of the trip by flying no more than 600 miles in any one day and thus getting in early in the afternoons without being too tired to enjoy the many things there were to see. We found flying to be far easier and much less tiresome than driving and of course the time much shorter. My wife was skeptical at the start but has now agreed that it is a great way to travel.

END

The Industry

FIGURES in the following table, supplied to POPULAR AVIATION through special arrangement with the Civil Aeronautics Authority, cover the aviation industry in the United States as of April 1:

Total pilot certificates of competency, active	33,188
Airline pilot certificates of competency, active	1,196
Student pilot certificates, active	32,819
Glider pilot certificates of competency, active	149
Mechanic certificates of competency, active	10,170
Parachute rigger certificates of competency, active	430
Uncertificated aircraft, active	12,505
Certificated gliders, active	528
Certificated gliders, active	40
Uncertificated gliders, active	82
Ground instructors' certificates of competency, active	616
Air-traffic control-tower operators' certificates of competency, active	224

Speeder Upper

AN Army Air Corps captain unwittingly discovered a high altitude "speeder upper" while flying a B-18A bomber on a bombing mission recently. Capt. Budd J. Peaslee of the 30th Bombardment Group, March Field, Cal., was flying his ship in a formation at 18,000 feet when he suddenly realized that his ship was falling behind the rest of the formation. Captain Peaslee and his co-pilot opened the engine's throttles wide but still their bomber didn't seem to catch up. As a last but aimless effort, Captain Peaslee lowered his flaps. Immediately, to everyone's amazement, the lagging bomber seemed to leap ahead, climbing fast as it overtook the rest of the squadron. This accidental discovery was credited with helping Captain Peaslee turn in the best high altitude bombing score on March Field's records.

Cautious Jeweler

A SEATTLE jeweler, fearful that the war would stop shipments of diamonds from Europe and Africa, recently had 2,612 diamonds flown to him by transatlantic and transcontinental airline. The shipment took four days (against 20 days of surface transportation) and cost $80 in postage alone.

The DEADLY SHOW-OFF

By
JOHN C. A. WATKINS

Reckless flyers still plague aviation, though the C.A.A. is wiping them out. Ending the article begun in June.

★

ONE of the favorite show-off tactics of student and commercial pilots alike, the C.A.A. has found, is the steep, spectacular take-off. It kills dozens of pilots every year and may be traceable back to aviation motion pictures in which the pilots invariably take-off as if they were flying interceptor pursuit planes and had just received word that enemy bombers had reached the munitions factory.

Two good examples of this were made public recently by the Air Safety Board. One involved a private pilot who killed himself and two young women passengers. The other involved a commercial pilot *with 11,000 flying hours.* In the latter accident the pilot was injured seriously, so was the co-pilot, and three passengers were killed.

The private pilot took off with the girls on what was described as a "local pleasure flight." Immediately "the aircraft was pulled up after approximately two-thirds of the available runway was crossed, and climbed very steeply until an altitude of approximately 200 feet was reached. The pilot then began a sharp climbing left turn for another hundred feet, when the aircraft stalled and went into a left power spin. The pilot failed to recover control and the aircraft crashed in an open field adjacent to the airport. The aircraft was destroyed by the impact and all three occupants were killed."

The other case involved a twin-engined airliner owned by a New Yorker and flown to East Hartford, Conn., to have some work done at the plant of the United Aircraft Corporation. After the airplane was inspected, the pilot took off for Roosevelt Field.

"The aircraft left the ground on the take-off as the aircraft reached a speed of approximately 50 or 60 m.p.h. after a run of approximately 1,000 feet," the crash report said. "*The tail of the aircraft* (italics are mine) *was forced down on the take-off to such an extent that the tail wheel almost touched the ground.* The aircraft continued in a steep climbing attitude until it reached an altitude of approximately 70 feet, at a point just inside the field boundary, when the left engine stopped. The left wing dropped suddenly . . . and the aircraft yawed sharply to the left and began to settle from this altitude in a nose high attitude."

The examining board which held a public hearing on the accident found that the probable cause was "failure of left engine following a take-off of such nature as to necessitate a forced landing under hazardous conditions," and that the contributing factor was "failure of the pilot to attain sufficient speed during the take-off to insure single-engine operation of the aircraft."

Obviously it *never* pays to take a chance. A pilot never knows when his engine is going to quit suddenly. He never knows, when he is flying a lightplane and is taking off or landing, that he isn't going to be caught by a downdraft. Twenty-four typical reports from the Air Safety Board, on as many fatal or near-fatal accidents, prove the old timers wise in avoiding anything smacking of recklessness. Of the 24, two resulted from structural failures caused by steep power dives, three were the result of pilots willfully flying into bad weather or continuing flights after they had encountered bad weather, three by steep turns at low altitudes, four by steep take-offs from which the ships stalled and 12 were caused by acrobatics at low altitudes. Note that 50 per cent of them were the result of low acrobatics.

An Ohio commercial pilot and a passenger were killed recently in a typical example of the unexpected happening when pilots take chances. The pilot was flying about the airport and suddenly dived at the field, "passing between the hangar and a barn at 50 to 100 feet from the ground and executed a sharp right turn." During the turn the airplane stalled and crashed.

Last May a student pilot in New York

(*Continued on page* 70)

Stunts like this cause the majority of serious accidents in private flying. The pilot of this ship was using the automobile for a pylon, just missed hitting the girl at right.

Two men in this ship were killed. They had been stunting at very low altitude when the pilot momentarily lost control, the plane fell off into a spin and crashed before recovering.

The east entrance of the Smithsonian Aircraft Building has a World War tank and cannon on adjacent walk.

Plane Parade

by EDWARD LAWSON

One of the most important, complete aviation shows on earth is permanently located in the Smithsonian Institution in Washington, D. C.

THE whole thrilling story of the aviation industry—from its legendary beginnings with Icarus and Daedalus, Pegasus and the Winged Horse and the Magic Carpet, to its present era of ultra-modern, ultra-comfortable, ultra-speedy transports—now is on view in Washington, D. C.—a spine-tingling exhibit guaranteed to pump the pulse of any air enthusiast.

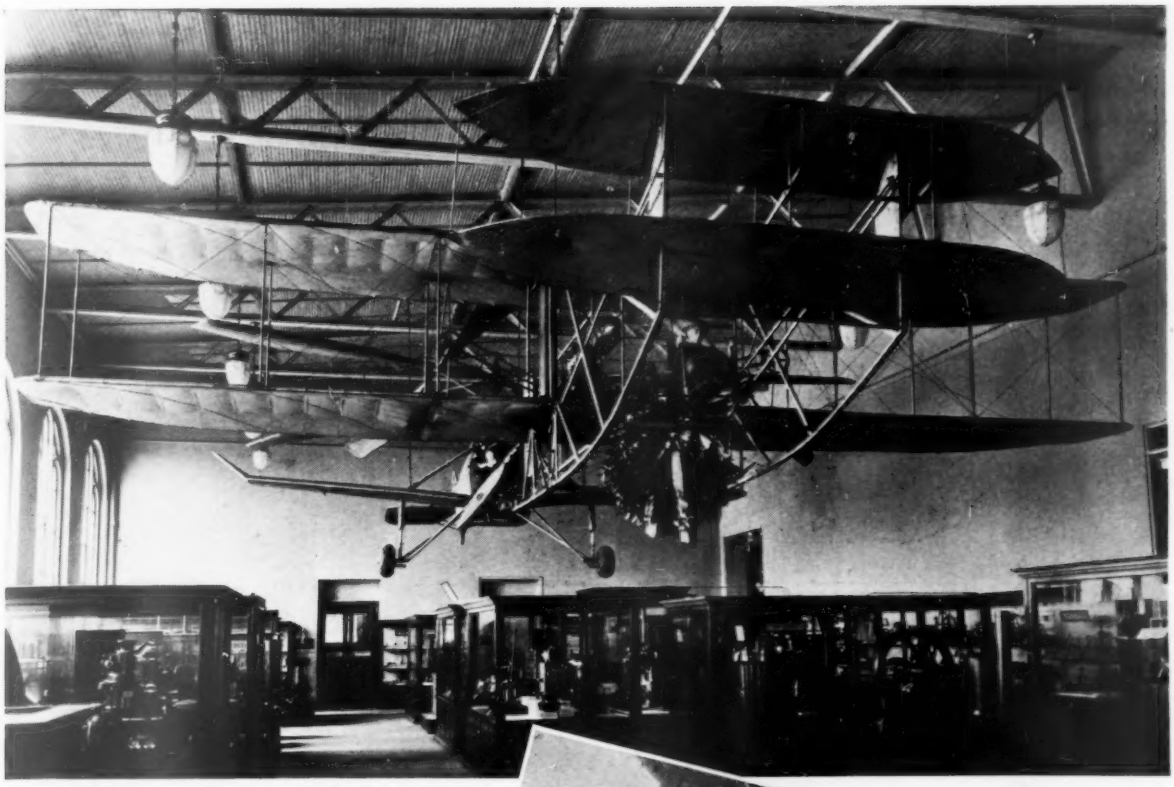
Unfortunately, each year hundreds of thousands of air-minded visitors to the nation's capital miss this treat because they don't know it exists. They see the famous cherry trees, the White House, the Monument and the Capitol, but too frequently they pass without a second thought the low-roofed, barn-like hangar midway between the latter two, where the nation's aviation treasures are displayed.

This unimpressive structure—and the ancient, rambling red-brick building of the old Smithsonian building that almost hides it from view—together house what is officially known as the Aircraft Collection of the National Museum—as interesting a selection of famous, history-making planes as can be found anywhere in the world.

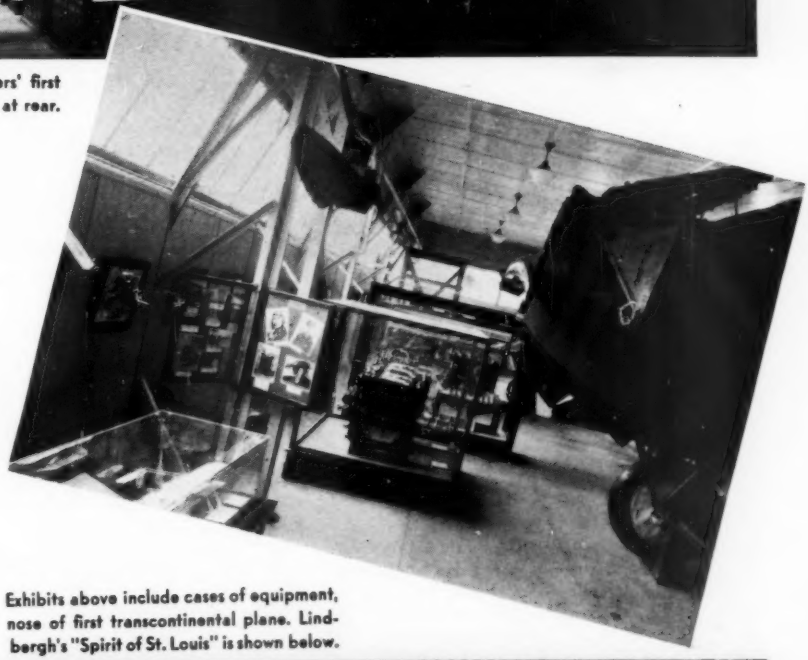
Over 100,000 visitors pass through their long halls every year to gaze with awe upon the famous craft of days gone by—planes which carried Lindbergh, Post, Ellsworth and dozens of less-well-known pioneers on their long-remembered flights. So fascinating is the show, and so big and so complete, that many who come once return time after time to view these aging, weather-beaten ships.

No. 1 on nearly every visitor's list is usually Lindbergh's silver *Spirit of St. Louis*. Suspended from the ceiling of the older building's center hall it hangs in the place of honor, the first thing one sees when he steps inside the door. The well-known markings, NX-211, still sprawl along the underside of its wings and on its nose can be seen miniatures of the flags of all the countries visited on good-will flights. Beneath the plane, neatly arranged in a display case, are a number of Lindbergh's personal flying possessions—his suit, helmet, goggles, boots, pack strap, waterproof match box, first-aid kit, emergency rations, maps, tools, rifle and compass. Most interesting are the many respects in which these differ from present-day equipment. Less than 13 years old, some look like relics from an early age.

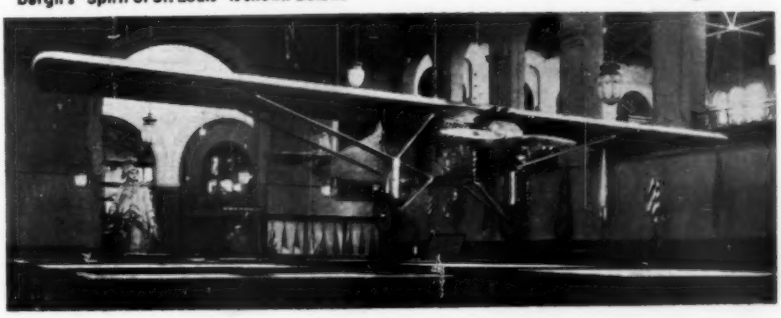
In an adjoining room hangs the speedy *Winnie Mae* in which the late Wiley Post flew around the world twice, first in 1931 with Harold Gatty in 8⅔ days; again in 1933 alone in 7¾ days; and in which he later conducted a series of experimental substratosphere flights. It is hard to believe that this fragile-looking



Hanging from the ceiling is the Wright Brothers' first military ship delivered to Army. Autogiro hangs at rear.



Exhibits above include cases of equipment, nose of first transcontinental plane. Lindbergh's "Spirit of St. Louis" is shown below.



little Lockheed ever would have been capable of tearing its way around the globe—a good 16,000 miles at least—in just a few hours more than one week, yet that's what it did. They also say that in May, 1935, its lean white-and-blue body streaked eastward from Los Angeles to Cleveland, high in the stratosphere.

In nearby rooms such other famous craft as Langley's *Aerodrome No. 5,* the Wright brothers' 1908 creation and Juan de la Cierva's first successful autogiro dangle proudly from the high arched ceilings. Langley's model which, on May 6, 1896, achieved a non-piloted flight of more than half a mile, is about 14 feet in span, weighs 26 pounds, and is powered by a one-horsepower flash-steam engine driving two pusher propellers. Launched from a catapault on a houseboat in the Potomac River, it made three wide circles and landed only when its power was exhausted. Other longer flights proved that its performance was not freakish and that its principles were sound. These hops surpassed by more than 12 times the best distance flights of Langley's most advanced predecessors.

The Wright 1908 model is the one in which Orville, at Fort Myer, Va., first demonstrated that his airplane could make hops of over half an hour, carry a passenger and make round trips from one city to another. These flights, made before War Department officials in 1908 and 1909, proved the value of the air-

(*Continued on page* 74)

Embryo aircraft engine mechanics gather around an instructor at the technical school at St. Thomas.

Groundling School

by L. B. Birdsall

Canada's aviation training forces have expanded tremendously with the war. This school is training thousands of aircraft ground workers.

THE importance that is being attached to ground or maintenance men in the vast scheme of military aviation that is being inaugurated in Canada under the name of the British Commonwealth Air Training Scheme is indicated by one instructional unit alone—R.C.A.F. No. 1 Technical Training School at St. Thomas, Ontario.

Built by the Ontario government at a cost of nearly $7,000,000 as the largest and most modern institution for the treatment of mental diseases in the British Empire, the large group of limestone buildings was not completed when they were taken over by the National Department of Defense at Ottawa within a few weeks after the outbreak of the war. The buildings now are being rapidly equipped and staffed for the instruction of maintenance and repair men in a series of practical courses which will cover about 18 weeks each. The courses are designed to turn out young men who are competent to service fighting planes. They will not be experts in any phase of the work, but they will be qualified mechanics who have trained in the various phases of engine and framework maintenance and repair.

The school is designed to take care of a complement of 2,500 students but, in the event of increased demands for ground men, the buildings being used for barracks can accommodate as many as 3,500 students. On the basis of a complement of 2,500 students, approximately 1,100 will be in training as engine mechanics, 1,100 as aircraft mechanics and the remainder as electrical and instrument workers, fabric workers and repair men, parachute packers and repair men and metal workers.

In addition to the ground training facilities being centered in No. 1 Technical Training School at St. Thomas, the large receiving hospital and connected surgical and laboratory wards built by the Ontario government for mental patients are being utilized by the Department of National Defense as a base hospital in the British Commonwealth Air Training Scheme. The hospital has ward space for 200 beds if required, with a large, fully-equipped x-ray department. Use of a flying ambulance for the transporting of patients to the hospital from other training stations and centers in the district is proposed. Accommodations are also provided for the operation of a dental hospital base.

Many of the members of the training staff of the school are veterans of Royal Air Force service who have been sent to Canada from England to assist in inaugurating the Empire Air Training Scheme and in co-ordinating the training with that being advanced in the British schools. The officer in command of the school, Wing Commander Reginald Collis, enrolled with the Royal Flying Corps in England a month after the R.F.C. was started in May, 1912, and has been in active service ever since. Wing Commander A. E. Case, senior officer in charge of technical training, also started his military flying career in 1912 with the Royal Naval Wing, after being in service as a marine engineer with the British Merchant Marine for five years. He had nearly 20 years of service as technician and technical director in England, Egypt and the Mediterranean when he was transferred to Canada. The senior administrative officer is Wing Commander H. G. Reid, C.M.G., C.B.E., D.S.O., whose military career dates back to the South African War when he went overseas at the age of 18 years as a graduate of the Royal Military College at Kingston, Ontario. Wing Commander Reid was living the peaceful life of a planter on the lovely island of St. Lucia, British West Indies, when this war began and he was called back into service because of his many years of experience in military administrative work.

During peacetimes, the R.C.A.F. had a permanent force of 260 officers and 1,955 men. Under the same conditions the auxiliary air force stood at 208 officers and 1,014 men. Since the declaration of war, of course, the R.C.A.F. has been swollen so as to dwarf its peacetime size. Since its inception in 1924, the R.C.A.F. has been administered by the Department of National Defense and, until recently, was under the control of the chief of the general staff of the Canadian Militia. On November 19, 1938, this control was turned over to the senior air officer whose title then was changed to Chief of the Air Staff.

Even prior to the war the R.C.A.F. had been in the process of expansion. This program was started in 1936. Now the R.C.A.F. is conducting one of the largest mass training programs, both in flight and ground work, in the history of aviation. In addition to the thousands of ground men now being turned out by schools like that at St. Thomas, the R.C.A.F. program is supplying thousands of trained pilots to the Royal Air Force in Great Britain.

Wing Commander Case — Wing Commander Collis — Wing Commander Reid

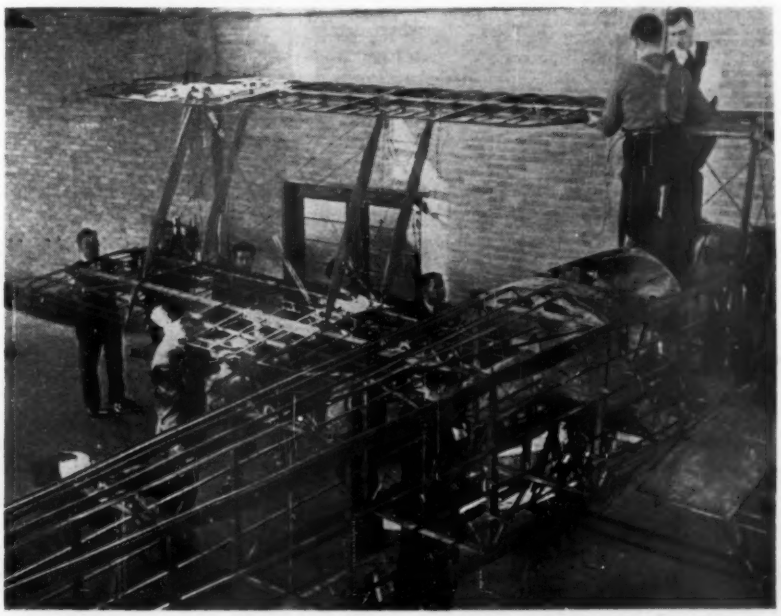
Aircraft used in the R.C.A.F. program are almost entirely British and American designs. A number of the first-line British warplanes currently in use against the Germans are also in use in Canada. It is one of these later-type warplanes that great emphasis is being made from the standpoint of the training of ground men. Hence it can be seen that schools like the St. Thomas unit are playing a major role in the war.

Except that the young men who attend the school are enlisted men under Canadian military discipline, it is not unlike large residential schools that are operated in Canada and the United States. Officers in charge of welfare and entertainment plan programs of supervised sports for all seasons of the year and provide other recreational facilities. The school is divided into two large barracks wings or blocks, with separate libraries and recreational rooms for each wing. A feature of the school is that all the buildings are connected by hallways and tunnels including the large three-story hotel-like brick structure, removed from the other buildings, in which the officers and technical instructors are quartered. From the time a person enters the administration building he may visit every building in the group without going out-of-doors. He travels through miles of hallways and tunnels.

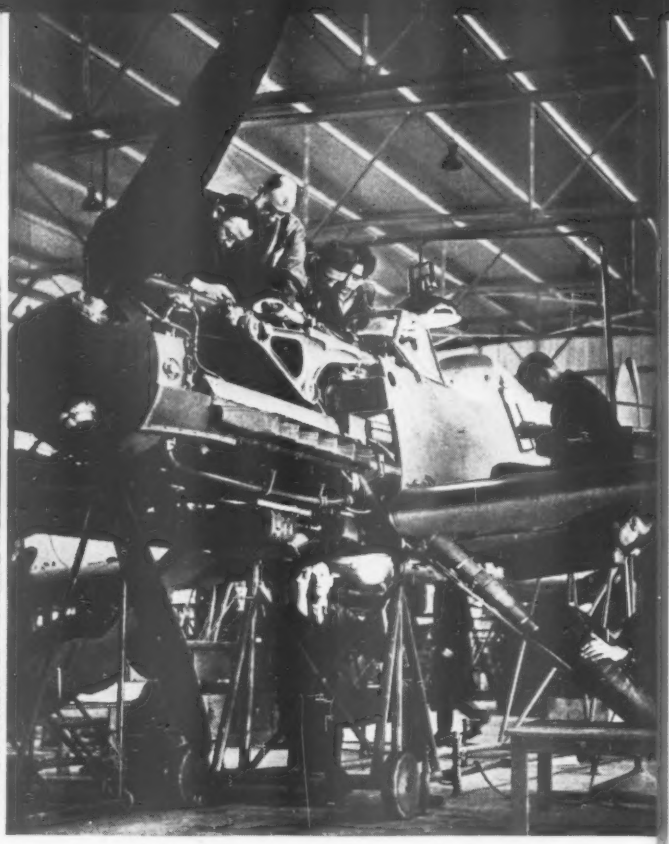
The only buildings that the Department of National Defense found it necessary to provide in order to complete this immense ground school are the assembly and drill hall and a large training hangar, now under construction. The assembly and drill hall will accommodate 2,000 men at one time. The school is regarded as being the finest set-up of its kind in the British Empire.

END

A class in airplane construction (below) is engaged in re-assembling an old trainer which had been torn down by a previous class. These students are attaching a wing.



Me-109 fuselages are shown on the production line of the Messerschmitt factory at Augsberg. Recently, many women have been working in factories.



A fighter rolls down the final assembly line. Engine, propeller, guns and landing gear are being added at this stage.

Warbird Nest

OUTSTANDING German fighter of the current war unquestionably is the Messerschmitt Me-109. Although POPULAR AVIATION has published many photographs of this prominent warplane in recent issues, the editors considered the series of Messerschmitt pictures on this page highly newsworthy. The photographs at the top and lower left-hand corner of the page are rare views of the Messerschmitt production line. They graphically portray the mass production methods being used by the Germans in turning out first-line fighters. The Me-109, standard single-engined fighter of the German air force, is powered with a 1,150 h.p. Daimler-Benz liquid cooled engine. It is armed with four .312 caliber machine guns and one 23 mm. cannon. A detailed cutaway drawing of this ship can be found on page 27 of the March issue of POPULAR AVIATION. Its top speed at 12,300 feet is 354 m.p.h., cruising range is 621 miles. Service ceiling is 36,000 feet.

One of the rare pictures of Willy Messerschmitt (left) shows him with Goering.

This is the final assembly line, looking toward the front. Bare fuselages roll along, picking up wings, instruments, engine and armament.

Many Me-109's have been shot down by the Allies. That below fell victim to an American-built Curtiss fighter of the French.

Air Vice-Marshal Croil fought at Salonika and piloted Col. T. E. Lawrence of Arabia.

BRASS HAT

by Frank Flaherty

He scrubbed decks all the way from India to earn his wings in the last war. The work of training pilots in Canada now is in his charge.

AIR Vice-Marshal George Mitchell Croil scrubbed decks all the way from India to the British Isles to gain a place in the fighting forces of the first great war but starts off as a leader in the second world conflict. He is one of the many "brass hats" in the Allied armies of today who were front line fighters 25 years ago, men who know from personal and often painful experience just what the fellows facing the guns have to contend with.

In the last war Croil saw air operations quickly pass out of the stunt stage and become one of the major phases in the clash of armed nations. In the years of peace intervening he has seen the Royal Canadian Air Force develop nothing until it faced the first real test of war last September. That test found Croil chief of the Canadian air staff but events since then have enlarged the scope of his duties.

By virtue of his position as head of the Canadian air force this quiet-spoken, modest, American-born Scotsman now is director of the British Commonwealth Air Training Plan, the biggest venture in the mass training of fighting airmen ever projected in any country. He is principal of a chain of air schools stretching across Canada which will turn out 20,000 to 30,000 pilots, air observers and air gunners in a year when it reaches maximum capacity.

As the first of the 70-odd schools comprising the chain go into operation under Croil's leadership the process of assembling and organizing a staff of 40,000 executives, instructors, mechanics and other operating personnel goes on. In the schools, adventurous youths from Canada, Great Britain, Australia and New Zealand will learn the ways of war and pass into the theatre of operations.

Three countries—the United States, Canada and Scotland—contributed to Croil's up-bringing. He was born in Milwaukee 46 years ago but when he was a boy his family moved to Montreal and later returned to their original domicile in Scotland. There the future air commander was apprenticed as an engineer and did his first soldiering as a private in the territorial army.

When armies started moving in 1914 he was working on a rubber plantation in Ceylon and at once started for Scotland. At Bombay the Lascar crew of the steamer heard of the war in Europe, decided they wanted nothing of it and deserted in a body. So Croil and the other passengers had to fall in and do all the menial tasks aboard the ship for the rest of the voyage.

Obtaining a commission in the famed Scottish regiment, the Gordon Highlanders, Croil started his training as an infantry officer but like many another youth he was attracted by stories about the thrills of warfare in the air. The British air establishment was small then and few realized the role it was to play in that and future wars. It was known simply as an "air battalion". Croil obtained a transfer from the Gordons.

It was a simple matter to become a pilot in those days compared to the present when 150 hours dual and solo flying is required before a man obtains his "wings" in the Royal Canadian Air Force. Then Croil was packed off to fly over the Salonika front with only 37 hours flying to his credit. At that he had a lot more than many another lad who made a name for himself from 1914 to 1918.

The Salonika front, where the Allies were hammering at Germany's back door, presented a somewhat different type of warfare to that on the French front where the great aces—Bishop of

(*Continued on page* 78)

Secretary of Labor Frances Perkins is greeted by apprentices after opening the California employe training program.

SKILL TO ORDER

by M. H. CARRINGTON

Apprenticeship program, inaugurated at Lockheed plant, may insure steady supply of craftsmen for aircraft manufacturing industry, ending shortage.

HE is a young man, tall and lean, and with the look of an athlete about him. He is one of a group of 37, all between the ages of 18 and 23, standing beside a new Lockheed *Hudson* bomber listening to a few words from Miss Frances Perkins, Secretary of Labor.

We had just asked him why he had given up a job as a hand riveter at 57 cents an hour in the Lockheed factory to sign his life away for the next four years as an indentured apprentice whose starting wage would be no more than 36 cents an hour.

"Kinda weak on your mathematics, aren't you, buddy?" we had suggested, just to see what he would say.

"Most doctors had to be internes first, mister," he had replied. "Not much money then, but look at most of 'em now! Even the most successful lawyers had to scrimp and starve their way through pre-legal. They weren't so dumb and neither am I. I'm looking ahead a few years. But listen—Madame Secretary is trying to explain it all if you'll just listen for a moment."

And Miss Perkins, a visitor to the Lockheed plant, is presenting the true picture admirably to the young men who stand before her alongside the airplane.

"I am very glad to be able to be here and officially inaugurate the first apprenticeship program in the history of the manufacturing industry," Secretary Perkins is saying. "Your program is of very great interest to me because of the important part it will play in the future of American aviation.

"You are about to write a page in history—construction history. You are the first boys in America to become bona fide apprentices in the aircraft manufacturing industry.

"It is good to know that you realize that mastery of a skilled trade will give you something no one can take away from you; something you can market anywhere in the country. While apprenticeship may offer a smaller wage than you could earn in a blind-alley job where you would be learning little or nothing, now you will be building up your earning capacity, your independence for the rest of your life."

The young man turns to us and smiles. "Now do you get it?" he asks. Of course, we had had it all the time, but wanted to learn whether the young man actually had known what he was

doing and why he was doing it. He knew, all right, as did all of the 36 other young men completing the first group of indentured apprentices the American aircraft manufacturing industry had started on the road toward becoming something more than mere hour-by-hour laborers in dead-end jobs.

"Skilled workmen are as valuable to society as is the doctor of medicine," Miss Perkins is saying. "They create comforts for us, make life more livable. They are as important to our life today as were the blacksmiths in the early settlements of the American continent. And they will be more important than ever in days still to come."

"She's talking about me ten years from now," beams the young man. "About me and my pals here."

That was how the Lockheed apprenticeship program was launched officially one February morning at the factory in Burbank. Anxious to learn more of the plan and the underlying reasons for its inception, we went to see R. Randall Irwin, manager of industrial relations for Lockheed. Mr. Irwin lost no time in pointing out that the broadly skilled craftsman is the backbone of any industry and that Lockheed intends always to have a very strong backbone.

"All of industry, aircraft in particular, not so very long ago suddenly found itself faced with an acute shortage of highly skilled craftsmen, tool designers and production engineers," Mr. Irwin said in tracing the origin of the apprenticeship plan at Lockheed. "Due to the almost impossible demands made of the materials it uses, the aircraft manufacturing industry has been compelled to make tremendous strides in new developments and processes. These demand the presence on the job of trained, capable, all-around craftsmen. It was found that the operator trained in only one or two specialized fields was limited in ability to so great an extent that he was a handicap not only in the matter of personal progress but also to the industry itself.

"As a result of the concern of the War and Navy Departments and the Civil Aeronautics Authority over the possible shortage of highly skilled men to meet the needs of a national emergency, President Roosevelt appointed an interdepartmental committee on mechanics training in the aircraft industry.

"That committee emphatically urged the aircraft industry to adopt a program of apprentice training. Many manufacturers did not have the time, the patience or the foresight to be interested. 'We can train all the men we need in a few days' was the general attitude of many.

"The emergency broke in the last few months. When it came, it was found that the great mass of new employes could be trained to a great volume of productivity. But this was not true in the highly skilled trades requiring years of experience and training. For example, toolmakers, pattern makers, all-around machinists, tool designers and production engineers.

"The aircraft manufacturing industry was paying for the last decade, one in which less and less emphasis has been placed on maintaining the number of highly skilled workers in industry. The design and building of intricate machinery and complex tools, the forming and handling of new materials and the manipulation of new techniques were demanding the employment of trained workmen, the application of the highest skills."

"Mastery of a skilled trade will give you something no one can take away from you; something you can market anywhere," Madame Perkins told the first group of apprentice craftsmen. The plan, she said, was important to aviation's future.

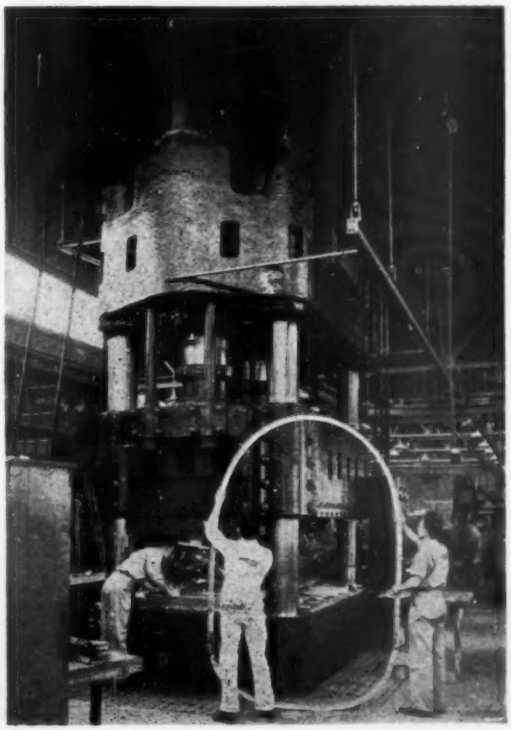
Mr. Irwin said that in the past the aircraft industry, to obtain this type of personnel, has employed the highly skilled men from other industries. The burden of training these men has been placed on the other industries from which they were recruited when needed.

In the last few months, other industries have increased their own business and employment to such a degree that the entire reserve of qualified craftsmen in these trades is exhausted. As a direct result, a system of piracy and price cutting among these industries in various sections of the country has developed.

As long as two years ago, the Lockheed Aircraft corporation recognized its share of responsibility in carrying the burden of developing craftsmen and conferred with representatives of the federal committee on apprenticeship, Department of Labor, about the development of an apprenticeship program at the Lockheed factory. With the assistance of the committee, this program has resulted through the cooperative efforts of the California State Bureau of Trade and Industrial Education, Bur-

(*Continued on page* 56)

Two trainees begin their four-year apprenticeship with work on a hydro-press at the Burbank factory. Press exerts 4,000,000 pounds maximum pressure.



This performance recording camera is a modified gun camera developed at Wright.

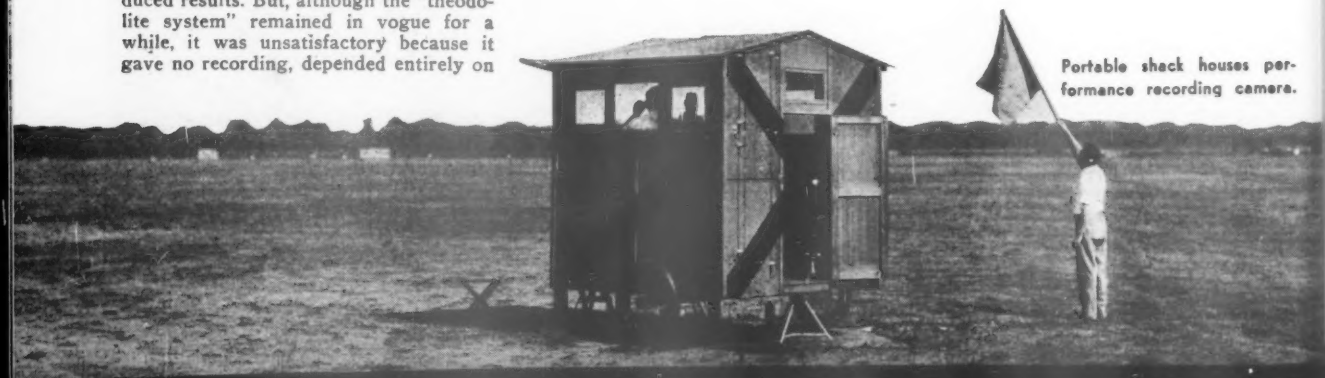
Landings BY THE YARDSTICK

by JAMES FARBER

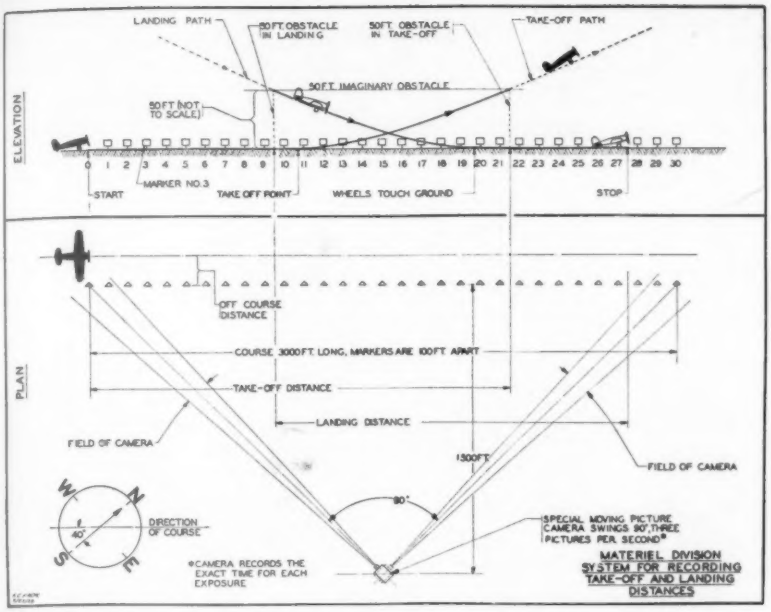
Aeronautical engineers long have wanted to know the exact performance characteristics of planes. A quiet Army expert devised the present system.

EXACT data concerning an airplane's landing and take-off performance and characteristics are vital to anyone who uses an airplane. Seven years ago Theophile de Port, aeronautical engineer with the Materiel Division of the Army Air Corps at Wright Field, Dayton, Ohio, was given the assignment to develop a system of recording such data. The method was left entirely up to him. All that engineers knew about the subject at that time was that it was becoming of increasing importance in view of the rapid advance of aviation reflected in bigger and faster airplanes. Obviously, they needed more landing and take-off room; but how much?

It was de Port's job to find out. The theodolite, an instrument for measuring angles but incapable of corrections for wind velocity and other factors, was all de Port and his associates had to start with. Properly used, the theodolite produced results. But, although the "theodolite system" remained in vogue for a while, it was unsatisfactory because it gave no recording, depended entirely on



Portable shack houses performance recording camera.


LANDING PATH
50FT. OBSTACLE IN LANDING
50FT. OBSTACLE IN TAKE-OFF
TAKE-OFF PATH
50FT. IMAGINARY OBSTACLE
50FT. (NOT TO SCALE)
ELEVATION
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
START
MARKER NO. 3
TAKE OFF POINT
WHEELS TOUCH GROUND
STOP
OFF COURSE DISTANCE
COURSE 3000FT. LONG, MARKERS ARE 100FT. APART
TAKE-OFF DISTANCE
LANDING DISTANCE
PLAN
FIELD OF CAMERA
1500FT.
FIELD OF CAMERA
90°
40°
DIRECTION OF COURSE
SPECIAL MOVING PICTURE CAMERA SWINGS 90°, THREE PICTURES PER SECOND*
*CAMERA RECORDS THE EXACT TIME FOR EACH EXPOSURE
MATERIEL DIVISION
SYSTEM FOR RECORDING TAKE-OFF AND LANDING DISTANCES

The complete landing and take-off measuring course is illustrated here. Results from this system give complete time-space record showing plane positions and velocities.

Theophile de Port

the personal skill of the observer, did not involve the use of triangulation and gave only the *approximate* distance of the 50-foot obstacle over which the plane ascended in the tests.

After lengthy experimentation the present photographic system was evolved. There are several systems in use besides that of the Army Air Corps. Some consist simply of photographing landings and take-offs, then measuring distances on the film. This obviously introduces much guesswork, hence the opportunity for a large margin of error. The faults of such a system are apparent: if the plane were not flying exactly over its course (the technician could only guess the point on the ground over which the plane was flying; in the picture he could not tell from looking at the film whether it was), the error might run to many feet. Likewise, the technician could only guess the point on the ground over which the airplane was flying in the picture to derive its altitude.

The Army Air Corps method takes all these factors into consideration. Its system of calculation is simple enough for a high school student to execute with accuracy virtually to the point of inches. There is a line of numbered marker flags spaced at 100-foot intervals in a straight line over a 3,000-foot course. This line contains 30 flags and is the line of flight. Four persons are required to operate the system: pilot. cameraman, anemometer observer and course observer.

The camera is in a portable shack 1,500 feet off the plane's line of flight and at right angles. This distance is not arbitrary, it is merely convenient for calculations in reference to the line of flags. When the pilot is ready to take off, the course observer stands back of the line of flags to record the distance the plane veers off its line of flight. In the foreground is the anemometer observer who measures the wind velocity.

As the pilot takes-off the cameraman "shoots" until the plane has from 50 to 75 feet altitude. Study of the accompanying film strip from an actual test shows what the camera sees. It is obvious that calculations based on known distances and on the data obtained by the course and anemometer observers are accurate. The position of the plane at any moment during the test is shown within two feet.

In making the landing test, the cameraman starts his camera when the plane gets down to about 100 feet and follows it until the wheels roll to a stop. From start to finish the standard stop-watch (as seen on the accompanying strip) makes a time record on the film with each exposure. An ordinary projector throws the picture on a chart card; they are projected one frame at a time. The chart represents a scale drawing of the actual course so that the images of the planes and marker flags fall on a set of figures that instantly tell the plane's exact horizontal and vertical position from the reference point (marker flag), together with the time recorded.

Tests are not made if the wind velocity is more than 10 m.p.h. Test figures are reduced to standard sea level conditions (altitude) in still air by means of corrections for air density, wind velocity and direction and difference in horsepower. These are the normal or ideal conditions of the test and are the basis of the pilot's decision as to what his ship will do if the wind is blowing 50 m.p.h. From six to nine runs normally consti-

Strip taken from camera gun shows a BC-1 taking off. Note that built-in stop watch records exact time of each film exposure.

tute a test. The pilot maintains as straight a flight path as possible parallel to the course, using his judgment in getting maximum performance. Safety margins are never shaved to a danger point nor is fishtailing, porpoising or zooming permissible. A median figure is obtained from the three best runs, since even the most expert pilots may vary from 50 to 100 feet off-course in runs under similar conditions.

Main piece of test equipment, of course, is the performance recording camera. That in use at Wright Field is a converted camera gun. However, certain improvements were developed in the Wright Field laboratory; slowing down the speed from 24 to four exposures per second; electric instead of spring drive, adapting film holders to carry 400 instead of 25 feet of film with the result that the camera can take 20 to 30 test runs with a single magazine. Also there is a 15-inch instead of an eight-inch telephoto lens, a special stop-watch permitting measurement of time intervals one-tenth that possible with the ordinary stop-watch, an optical marker to identify each test on the film and a film footage indicator.

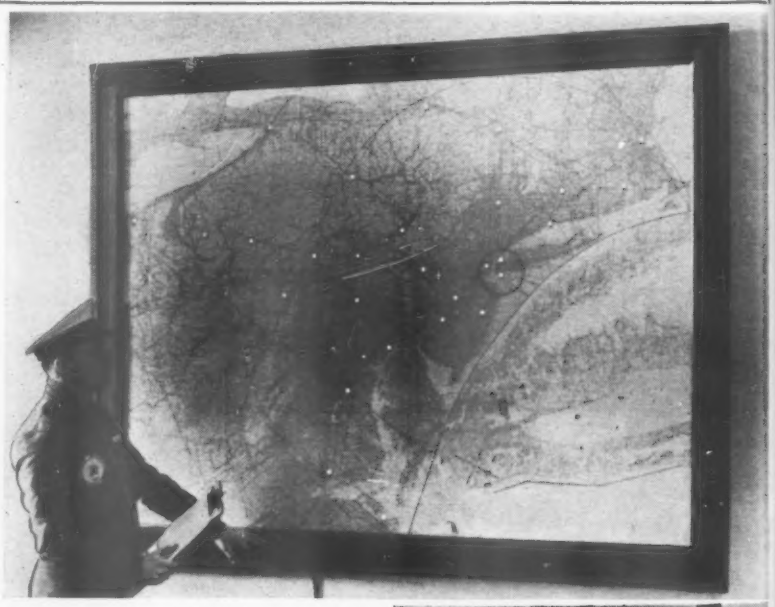
The War Department now requires that all new Army aircraft must undergo the photographic performance test known officially as "A System for Measuring Landing and Take-off Performances by Photography". All tests are performed under "ideal" conditions. However, a pilot provided with landing and take-off data for the particular ship he is to fly, can easily determine what that plane will do under various meteorological conditions. Airlines, ever anxious to extend their facilities, must know the landing and take-off characteristics of their ships. Commercial and military pilots must know that they can get in and out of given areas. Considering the airlines' use of the technical data involved, it is pertinent to note some of the conclusions of the de Port system:

The size of landing fields naturally exercise vital influence on the design of aircraft and, conversely, design of aircraft influences the size of fields. If all fields were strictly limited in size, then aircraft landing and take-off characteristics would be correspondingly limited and hence would restrict aircraft design. Since the trend is toward bigger and faster commercial and military ships, airports must be constructed accordingly. Another significant conclusion is that it isn't the landing *speed* of airplanes that counts so much as take-off and landing *distance*. Contrary to previous notions, the reason is simple: if an airplane requires a given distance for take-off, the field must necessarily be at least as large as that given distance regardless of how fast the airplane can take off.

Mr. de Port is a graduate of the University of Paris. When Wilbur Wright demonstrated his biplane to the French government at Pau and Etamps, de Port was one of the engineers sent to watch and assist. He once worked for Deperdussin as a designing engineer, then built gliders for the Societe des Aviateurs

(*Continued on page 76*)

Weather Board



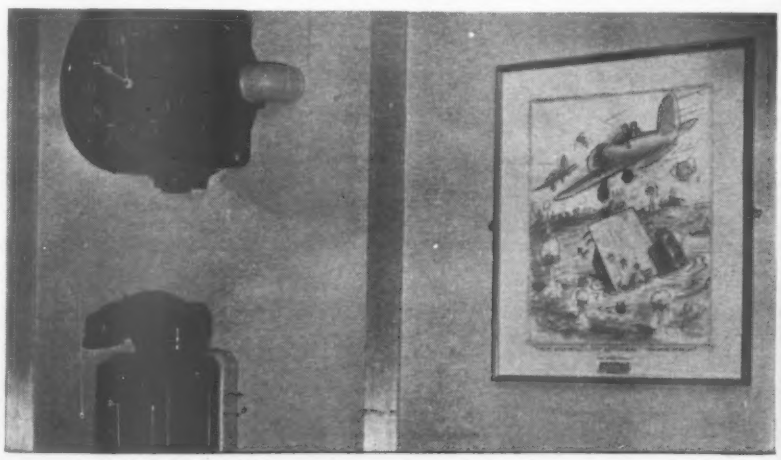
Radioman Williams is shown operating his newly-developed weather map for flyers.

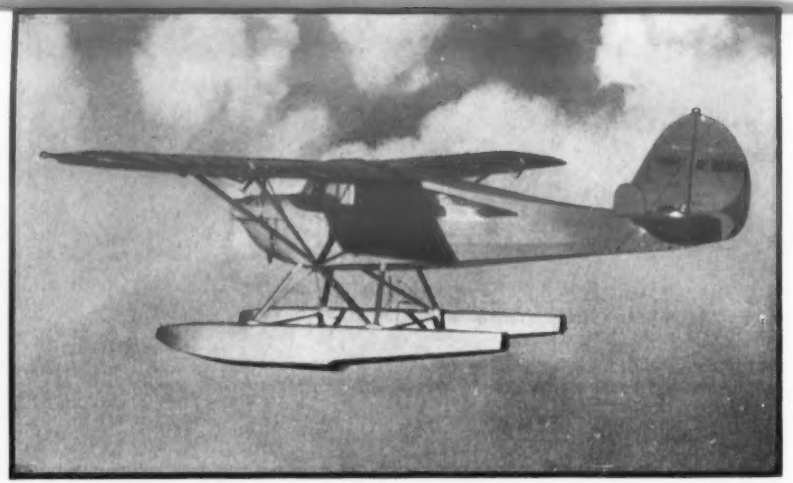
PILOTS stopping at the U. S. Naval Air Base at Floyd Bennett Field, New York, now can tell at a glance the status of the weather throughout the northeastern section of the Atlantic coast. Developed by Chief Radioman H. A. Williams (in pictures), the map features red, white and green lights (closed, instruments and open respectively). Inset shows Williams setting lights for various cities.

P. A. Goes to Sea

NOW hanging in the wardroom of the *U. S. S. Yorktown* is the original Dick Shaw cartoon which appeared in the March issue of POPULAR AVIATION. It depicted an aircraft carrier sinking with a stranded landplane flying overhead. The observer tells the pilot: "Y'never could depend on that outfit of ours. Now where do we go? . . ." Shortly after the March issue appeared Capt. Ernest L. Gunther, commander of the Navy's big carrier, asked for the original drawing.

The original of Popular Aviation's cartoon hangs in the wardroom of the "Yorktown".

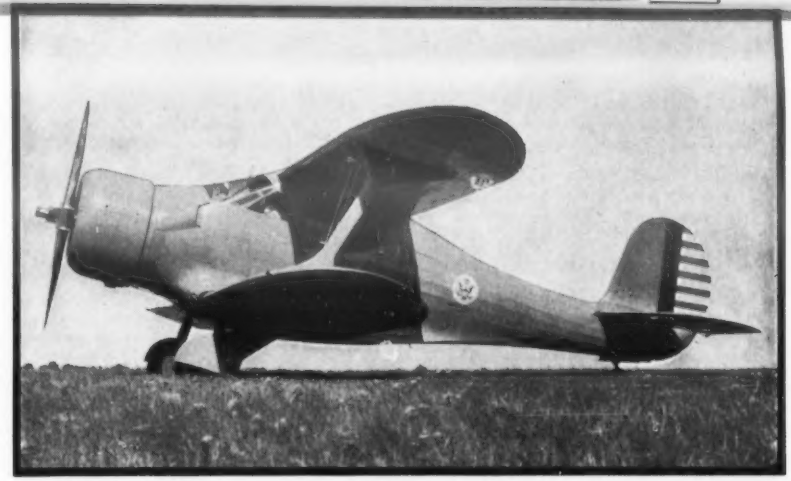




AERONCA

"Chief" Seaplane, S-65C

Aeronautical Corporation of America — Lunken Airport, Cincinnati, Ohio



BEECHCRAFT

D17S

Beech Aircraft Corporation — Wichita, Kansas

AIRCRAFT

BEECHCRAFT

E17B

Beech Aircraft Corporation — Wichita, Kansas

AIRCRAFT

CESSNA

Airmaster, C-165

Cessna Aircraft Company — Wichita, Kansas

BEECHCRAFT D17S

COSTS: List price: $18,870. Minimum down payment: $7,548. Annual insurance premium: $1,839.82. Operating cost per hour: $18.45.

PERFORMANCE: Miles per gallon of fuel: 8.8. Cruising speed at 66% horsepower: 202 m.p.h. Maximum speed at 9,700 feet: 203 m.p.h. Stalling speed: 50 m.p.h. Cruising range (excluding 10% fuel reserve): 755 miles. Service ceiling: 25,000 ft.

SPECIFICATIONS: A. T. C. No. 649. Type of airplane: CLB. Type of construction: wood, metal, fabric. Engine 450 h.p. Pratt & Whitney SB Wasp Jr. Fuel capacity: 100 gals. Weight empty: 2,540 lbs. Weight loaded: 4,200 lbs. Span: 32 ft. Height: 8 ft. Length: 25 ft. 11.07 in. Wing area: 296.5 sq. ft. Wing loading: 11.97.

ACCOMMODATION: Number of seats: 5. Baggage: 125 lbs.

EQUIPMENT: Instruments (standard on this model): airspeed indicator, altimeter, turn and bank indicator, vertical speed indicator, compass, tachometer, engine gauge unit (oil pressure, oil temperature, fuel pressure), manifold pressure gauge, clock, head temperature gauge, ammeter, two Moonglow projector type instrument lights, electric tab position indicator, electric gasoline gauge with selector switch, set of navigation lights, radio bonding and shielding.
Interior fittings: cabin heating and ventilating system, non-shatterable safety glass windshield and windows, cabin soundproofing, throw-over control column.

Propeller: Hamilton Standard, controllable pitch.

SPECIAL FEATURES: retractable landing gear and tail wheel (electrically operated, with auxiliary hand control), electrically operated trailing edge flaps on lower wings, negative wing stagger, full vision curved safety glass windshield, cantilever tail construction. Available as sea- or ski-plane.

CESSNA Airmaster, C-165

COSTS: List price: $7,575. Minimum down payment: $2,525. Annual insurance premium: $727.20. Operating cost per hour: $10.12.

PERFORMANCE: Miles per gallon of fuel: 13.8. Cruising speed at 75% horsepower: 157 m.p.h. Maximum speed at sea level: 169 m.p.h. Stalling speed: 49 m.p.h. Cruising range (excluding 10% fuel reserve): 436 miles. Service ceiling: 19,300 ft.

SPECIFICATIONS: A. T. C. No. 701. Type of airplane: CLM. Type of construction: metal, wood, fabric. Engine: 165 h.p. Warner Super-Scarab. Fuel capacity: 35 gals. Weight empty: 1,400 lbs. Weight loaded: 2,350 lbs. Span: 34 ft. 2 in. Height: 7 ft. Length: 25 ft. Wing area: 181 sq. ft. Wing loading: 13.

ACCOMMODATION: Number of seats: 4. Baggage: 64 lbs.

EQUIPMENT: Instruments (standard on this model): compass, altimeter, airspeed, tachometer, fuel gauge, oil pressure, oil temperature, ammeter.
Interior fittings: foam rubber cushions, indirect instrument lighting, ventilating system (heating optional), baggage compartment, soundproofing.

Propeller: Curtiss-Reed, metal.

SPECIAL FEATURES: electric flaps, generator, navigation lights, shielding and bonding, locking swivel tail wheel, hydraulic brakes, dual controls, Plexiglas windshield. Also available as seaplane, skiplane, photo or ambulance plane.

AERONCA "Chief" Seaplane, S-65C

COSTS: List price: $2,389. Minimum down payment: $795.53. Annual insurance premium: $238.90. Operating cost per hour: $1.25.

PERFORMANCE: Miles per gallon of fuel: 20. Cruising speed at 75% horsepower: 85 m.p.h. Maximum speed at sea level: 95 m.p.h. Stalling speed: 35 m.p.h. Cruising range (excluding 10% fuel reserve): 200 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: T. C. No. 675. Type of airplane: CSM. Type of construction: wood, metal, fabric. Engine 65 h.p. Continental A-65. Fuel capacity: 12 gals. Weight empty: 780 lbs. Weight loaded: 1,253 lbs. Span: 36 ft. Height: 6 ft. 3 in. Length: 21 ft. Wing area: 169 sq. ft. Wing loading: 6.8.

ACCOMMODATION: Number of seats: 2. Baggage: 40 lbs.

EQUIPMENT: Instruments (standard on this model): tachometer, oil temperature gauge, oil pressure gauge, altimeter, airspeed indicator.

Interior fittings: leatherette upholstery, carburetor heater, spinner, first aid kit, fire extinguisher, log books, engine manual, wings wired for navigation lights, dual controls, dual safety belt, carpet, primer and two doors.

Propeller: fixed pitch, wood.

SPECIAL FEATURES: auxiliary fins, float fittings, steps.

BEECHCRAFT E17B

COSTS: List price: $12,380. Minimum down payment: $4,952. Annual insurance premium: $1,207.05. Operating cost per hour: $12.76.

PERFORMANCE: Miles per gallon of fuel: 11.1. Cruising speed at 75% horsepower: 177 m.p.h. Maximum speed at 7,200 feet: 182 m.p.h. Stalling speed: 45 m.p.h. Cruising range (excluding 10% fuel reserve): 630 miles. Service ceiling: 18,000 ft.

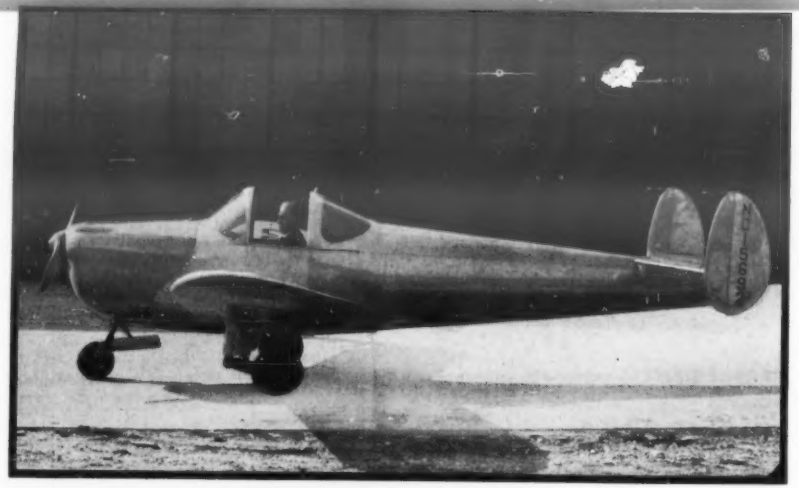
SPECIFICATIONS: A. T. C. No. 641. Type of airplane: CLB. Type of construction: metal, wood, fabric. Engine: 285 h.p. Jacobs L-5. Fuel capacity: 76 gals. Weight empty: 2,120 lbs. Weight loaded: 3,350 lbs. Span: 32 ft. Height: 8 ft. Length: 25 ft. 11¼ in. Wing area: 296.5 sq. ft. Wing loading: 11.3.

ACCOMMODATION: Number of seats: 5. Baggage: 125 lbs.

EQUIPMENT: Instruments (standard on this model): turn and bank indicator, vertical speed indicator, airspeed indicator, altimeter, compass, tachometer, fuel pressure gauge, oil pressure gauge, oil temperature gauge, 30 ampere ammeter, electric tab position indicator, gasoline gauge (electric, with selector switch), two Moonglow projector type instrument lights, navigation lights, radio bonding and shielding.
Interior fittings: cabin heating and ventilating system, non-shatterable safety glass windshield and windows, cabin soundproofing, throw-over control column.

Propeller: Curtiss-Reed fixed pitch, metal.

SPECIAL FEATURES: retractable landing gear and tail wheel (electrically operated, with auxiliary hand control), electrically operated trailing edge flaps on lower wings, negative wing stagger, full-vision curved safety glass windshield. Available as sea- or ski-plane.



ERCOUPE
415C

Engineering and Research Corporation — Riverdale, Maryland

FAIRCHILD
24-W40

Fairchild Aircraft — Hagerstown, Maryland

AIRCRAFT

FLEETWINGS
Seabird, F-5

Fleetwings, Incorporated — Bristol, Pennsylvania

AIRCRAFT

PORTERFIELD
90-W

Porterfield Aircraft Corporation — 2809 E. 14th St., Kansas City, Missouri

FAIRCHILD 24-W40

COSTS: List price: $6,290. Minimum down payment: $1,996.33. Annual insurance premium: $584.51. Operating cost per hour: $8-$10.

PERFORMANCE: Miles per gallon of fuel: 12.2. Cruising speed at 75% horsepower: 122 m.p.h. Maximum speed at sea level: 130 m.p.h. Stalling speed: 50 m.p.h. (with flaps). Cruising range (excluding 10% fuel reserve): 700 miles. Service ceiling: 15,700 ft.

SPECIFICATIONS: A. T. C. No. 707. Type of airplane: CLM. Type of construction: metal, wood, fabric. Engine: 145 h.p. Warner. Fuel capacity: 60 gals. Weight empty: 1,482 lbs. Weight loaded: 2,550 lbs. Span: 36 ft. 4 in. Height: 8 ft. Length: 23 ft. 9 in. Wing area: 174 sq. ft. Wing loading: 14.65.

ACCOMMODATION: Number of seats: 4. Baggage: 233 lbs.

EQUIPMENT: Instruments (standard on this model): compass, gas gauges, usual flight panel, hydraulic brakes, steerable tail wheel, electric starter, ventilators, navigation lights, instrument lights, parking brake.

Interior fittings: ash tray, glove compartment, adjustable pilot seat.

Propeller: wood, fixed pitch.

SPECIAL FEATURES: Flaps.

PORTERFIELD 90-W

COSTS: List price: $3,145. Minimum down payment: $1,047.28. Annual insurance premium: $471.75. Operating cost per hour: $3.69.

PERFORMANCE: Miles per gallon of fuel: 18.6. Cruising speed at 80% horsepower: 120 m.p.h. Maximum speed at sea level: 135 m.p.h. Stalling speed: 40 m.p.h. Cruising range (excluding 10% fuel reserve): 336 miles. Service ceiling: 20,000 ft.

SPECIFICATIONS: A. T. C. No. 611. Type of airplane: CLM. Type of construction: metal, wood, fabric. Engine: 90 h.p. Warner Scarab. Fuel capacity: 18 gals. Weight empty: 823 lbs. Weight loaded: 1,326 lbs. Span: 32 ft. Height: 6 ft. 8¾ in. Length: 20 ft. 6 in. Wing area: 147 sq. ft. Wing loading: 9.02.

ACCOMMODATION: Number of seats: 2. Baggage: 40 lbs.

EQUIPMENT: Instruments (standard on this model): compass, altimeter, airspeed indicator, tachometer, oil pressure gauge, oil temperature gauge.

Propeller: wood, fixed pitch.

ERCOUPE 415C

COSTS: List price: $2,640. Minimum down payment: $880. Annual insurance premium: $264. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 25. Cruising speed at 75% horsepower: 106 m.p.h. Maximum speed at sea level: 117 m.p.h. Stalling speed: 45 m.p.h. Cruising range (excluding 10% fuel reserve): 320 miles. Service ceiling: 14,000 ft.

SPECIFICATIONS: A. T. C. No. 718. Type of airplane: CLM. Type of construction: metal, fabric. Engine: 65 h.p. Continental A-65. Fuel capacity: 14 gals. Weight empty: 715 lbs. Weight loaded: 1,175 lbs. Span: 30 ft. Height: 5 ft. 11 in. Length: 20 ft. 9 in. Wing area: 142.6 sq. ft. Wing loading: 8.2.

ACCOMMODATION: Number of seats: 2. Baggage: 40 lbs.

EQUIPMENT: Instruments (standard on this model): engine instruments, compass, altimeter.

Propeller: wood, fixed pitch.

SPECIAL FEATURES: hydraulic brakes, tricycle landing gear:—two-control connection (giving coordination of rudder and ailerons with wheel control)—steerable nose wheel.

FLEETWINGS Seabird, F-5

COSTS: List price: $25,000-$38,500. Minimum down payment: $10,000-$15,400. Annual insurance premium: $2,500-$3,850. Operating cost per hour: $16.68 (based on 400 hours annually).

PERFORMANCE: Miles per gallon of fuel: 7.85. Cruising speed at 60% horsepower: 139 m.p.h. Maximum speed at sea level: 150 m.p.h. Stalling speed: 58 m.p.h. (with flaps). Cruising range (excluding 10% fuel reserve): 550 miles. Service ceiling: 14,300 ft.

SPECIFICATIONS: A. T. C. No. 680. Type of airplane: CAmM. Type of construction: stainless steel, fabric. Engine: 300 h.p. Jacobs L5. Fuel capacity: 70 gals. Weight empty: 2,550 lbs. Weight loaded: 3,850 lbs. (with optional controllable propeller). Span: 40 ft. 6 in. Height: 12 ft. 6 in. Length: 32 ft. Wing area: 235 sq. ft. Wing loading: 16.38.

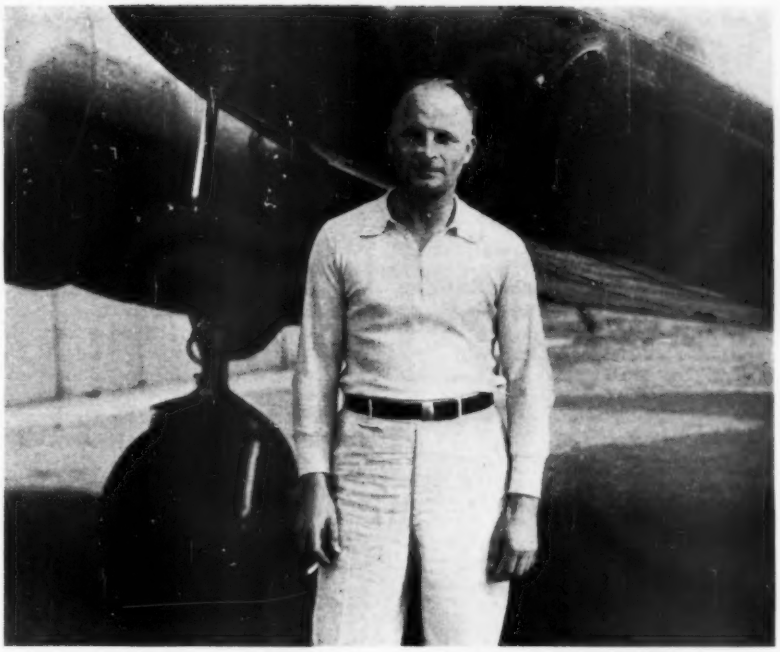
ACCOMMODATION: Number of seats: 4-5. Baggage: 150 lbs.

EQUIPMENT: Instruments (standard on this model): altimeter, thermocouple, manifold pressure gauge, clock, fuel pressure gauge, tachometer, ammeter, airspeed indicator, turn and bank indicator, rate of climb indicator, compass, wheel and flap position indicators, two fuel gauges, engine gauge unit, hydraulic pressure gauge. Interior fittings: anchor, cigar lighter, hand fire extinguisher, mooring line, cabin sound proofing, ventilating and heating system.

Propeller: Curtiss-Reed, metal.

SPECIAL FEATURES: hydraulically-operated split flaps, hydraulically-operated retractable landing gear, swivelling retractable tail wheel, landing and navigation lights, electric starter, elevator tab (adjustable in flight), balanced rudder and ailerons, retractable water rudder, hydraulic brakes.

FAIRCHILD 24-W40 ERCOUPE 415C



Marshall Headle succeeded the late Wiley Post as chief test pilot for Lockheed.

I Learned About FLYING From That! - No. 15

by Marshall Headle

Coming down through an overcast a test pilot found himself literally at sea without radio or compass. He'll never forget a compass again.

Marshall Headle, who succeeded the late Wiley Post as chief test pilot for Lockheed in 1929, was born in Winthrop, Mass., and obtained his B.S. degree at Massachusetts Agricultural College. When the United States entered the World War he enlisted immediately in the Air Corps. He subsequently instructed at Tours and Issoudun, France. At the end of the war he was attached to the United States Embassy in Paris, remaining at this post until 1922. That year he joined the United States Marine Corps and went to China. On his return to this country he became chief test pilot for Lockheed and has run tests on every model the company has manufactured since that time. In recent years he has virtually toured the world in the interests of his company.

FEDERAL regulations today call for compasses in planes making cross-country flights of more than 100 miles. To many pilots with a good sense of direction and an ability to read maps, this ruling perhaps seems a trifle onerous. In fact a great many abide by the letter of the ruling rather than the spirit. I have been in many private ships and have observed compasses in sad states of repair—rusted, improperly filled, and not compensated for deviation.

I would go farther than the C.A.A. has gone and require good compasses in proper repair as standard equipment on all airplanes I say this after a violation of the rules of common sense in 1935 while testing a Lockheed *Altair*, which might have brought death to both the engineer who went up on an absolute ceiling test with me, and myself. After five years of testing Lockheeds I should have known better. In fact I did know better. I just got careless.

A natural argument presented itself—an argument which at one time enters the minds of all pilots. It was:

"Why do I need a compass when I'm just going to spiral up and spiral down over territory over which I've been flying for five years? Why, I know every roof top, peak, highway and railroad within a hundred miles."

The circumstances were these: As chief test pilot I am vitally interested in every plane which leaves the factory. Until two years ago, when heavy production began and it also became necessary for me to travel to all parts of the world, I personally tested every ship which rolled onto the runway. The *Altair* was one of these and I had flown it extensively. It had a floor compass of excellent quality. However, I had found little need of it.

One day C. L. Johnson, engineer, said to me: "I want to get absolute ceiling on the job. What do you say?"

I ordered oxygen equipment installed and a little while later we took off on what was supposed to be a 50-minute climb to the top, which I estimated at about 22,000 feet. The air was mucky. There was a heavy overcast at 14,000. Visibility was down to around seven or eight miles.

Fortunately, I took off with a heavy load of gasoline. We started up, Johnson checking the panel instruments, which were working perfectly. I felt around and settled down to about 108 m.p.h., a speed which indicated maximum climb. Everything was perfect until we hit the overcast more than two miles up. I looked down—and the compass was gone!

It had been there the day before. But during the night it had been removed, possibly for checking. A small voice in the back of my head said:

"You'd better go down and get that compass."

A louder one replied:

"You've done this before. You know your stuff. You've gotten more than half way up. Why waste time, lose what you've gained?"

So I stuck with the job. I had no way of establishing direction, as the ship was not radio-equipped. I lulled myself into a deep sense of security with the thought that I'd come straight up and now I'd go straight down and be over Burbank.

We ran the tests. I had her wide open, nose up and we got approximately 22,000 feet. Johnson tapped me on the shoulder to indicate that he had learned all he wanted to know—he was sitting behind me in the narrow cockpit—and I started down. I hit the overcast, came on down through it, eased down through the heavy haze—and found myself over

(*Continued on page* 88)

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

JUDGING by the number of requests for applications to AOPA's Golden Wings Contest, it is starting off with a real bang. The contest, running for 10 weeks, was designed particularly to help the fixed-base operators, and, with their cooperation, should prove to be the biggest boost to private flying since the inauguration of the Civil Pilot Training Program by the C.A.A.

The fixed-base operator can now go to his students, friends or the local Chamber of Commerce for that matter and get them to go out and rustle up some business for him . . . for which they may win a new 65 h.p. Lycoming Aeronca *Chief* or one of the other prizes.

Radio Donated by RCA

RCA, hearing of the progress of AOPA's Golden Wings Contest, expressed its desire to cooperate. This cooperation has taken tangible form. Desiring to aid non-scheduled aviation, they are donating an RCA AVR-15A aircraft receiver complete with headphones which will be installed in the Aeronca *Chief* being awarded as first prize.

The contest blanks, which many of you have written in for, have all the rules printed on the reverse side. Here are the important points. In general the contest is open to anyone, 18 years of age or over, residing in the United States, except those who are engaged in instructing, soliciting, or organizing flight activity, and employes of the AOPA, the Aeronautical Corporation of America, their families or advertising agencies. One need not be a pilot to enter the contest. There are TWO parts to the contest. The first part deals with the obtaining of new students and/or the reinstatement of former students or pilots. The second part of the contest requires the applicant to write out briefly ten short statements describing an individual function, idea, or project which the AOPA might undertake to make flying "more useful, less expensive, safer, and more fun." The contest period runs from May 1st until July 15th so there is plenty of time to get started right now. For the purposes of the contest a "new student" is one who has logged a minimum of 5 hours dual time during the contest period. Sounds easy, doesn't it? It *is* easy, and we are just wondering who is going to walk off with that bright new, shiny 1940 Lycoming 65 h.p. Aeronca *Chief* . . .

TWA Courtesy Cards

We expect that all members who had never before been issued TWA Pilots' Courtesy Cards have received their special AOPA-TWA card by this time. Any members who failed to receive theirs should communicate immediately with J. B. Hartranft, Jr., Executive Secretary, at AOPA's newly opened office, 415 Lexington Avenue, New York City. We and the airlines have many problems to solve on such matters as traffic congestion and airway facilities. We hope always to be able to sit down and discuss these problems in a mutually beneficial manner. This step on the part of TWA is appreciated for we know that they are sincere and that the card, rather than a gesture, is intended to be a real service to the non-scheduled pilot. We would appreciate having reports on the use of these cards from our registered members. TWA has assured us that they wish to make this service do the best possible good. Your cooperation in sending frequent reports will, therefore, be of great assistance. Reports should be marked care of the Executive Secretary, AOPA.

Is the "LC" Needed?

Frequently in the AOPA Section (which is received monthly by all pilots registered with the AOPA) we have published letters sent in by the membership. These have been of greatest assistance to the executive board and have helped guide the policy of the AOPA. Frequently, also, we intend to circulate questionnaires to ascertain the *"average pilot's viewpoint"* on current and vital issues. *Your* cooperation in returning these questionnaires promptly may be the means of our acting more quickly and with greater effectiveness. A problem and a question of the moment is the scuttling of the LC license. Leo J. Scheberle, AOPA Pilot No. 614, states one side of the problem very well:

"Pilots for years have used the LC license to advantage in building up time for their commercial license. As it is now, many LC and prospective LC pilots are becoming discouraged, due to the great number of hours between the private and commercial license. Under the past set-up, the LC pilot could pay for his time with the revenue derived from local passenger flying, thereby furnishing the incentive to continue to work for the commercial rating. Result: more flying activity, greater progress in aviation. Under the new order of licensing, the pilot is stopped at the private-license stage because it will require an investment of approximately $1,000 more to obtain the commercial license. . . . I believe that most pilots will agree that the LC license should be continued or replaced with another giving the pilot the same advantages.

"The AOPA seems to be the only efficient pilot's organization that is really going ahead and getting things done, which is the reason I am writing to see what can be done to relieve this extremely inadequate licensing arrangement."

U. S. Chamber of Commerce—Shame!

We almost fell out of our chair when we came to the last page of the U. S. Chamber of Commerce Aviation Committee's report on airports which was presented to their annual meeting in Washington, D. C., last month. Had we not gone down there to put in a vigorous objection in behalf of the non-scheduled pilot, we would never have believed this progressive organization would sponsor such a report. We quote from page 8 of the report:

"No federal funds should be expended on commercial airports except under plans approved by the Civil Aeronautics Authority; *federal funds should be limited to airports serving communities for which the Authority has granted or is prepared to grant certificates for airline service* . . ."

And so, again, the non-scheduled pilot might have been left out in the cold. The AOPA was the only one to have a representative present to speak in behalf of the non-scheduled pilot.

Result: The report, we understand, was not officially adopted. In the future AOPA

(*Continued on page* 86)

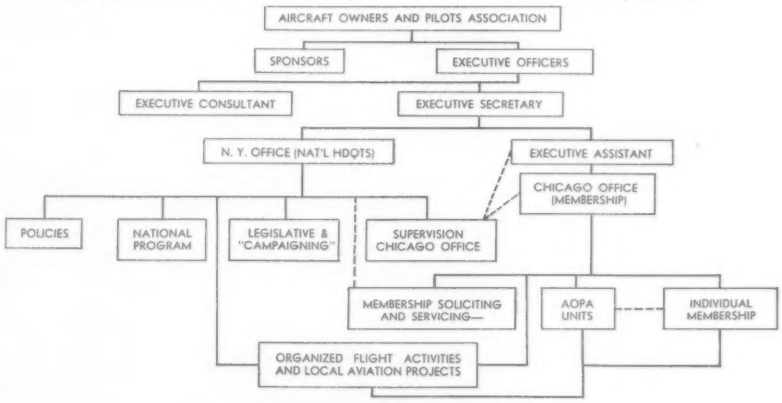


TABLE OF ORGANIZATION
AOPA
-1940-

J. B. Hartranft, Jr.
Executive Sec'y.

This chart graphically illustrates the setup of AOPA as described in article.

CHARTING PROPELLER EFFICIENCY

by RAOUL J. HOFFMAN

THE torque required to rotate a propeller will create an equal anti-torque or rolling moment on the airplane to which the engine is attached. This anti-torque is usually offset by giving one wing a greater angle of incidence. Again the slipstream, being of a helical nature, also will have unequal reactions on the tail surfaces. These reactions are minimized by setting the rudder at the angle the stream is approaching.

These conditions are increased on high speed planes with low power-loading. The increase in power enlarged the diameter of the propeller to the size that the resulting tip speed was higher than the speed of sound. Tests have shown that an air-foil loses its efficiency if moved faster than 1,000 feet per second. Therefore reduction gears were placed in the engine and tests were conducted with propellers having wider blades, with multi-blade propellers and tandem propellers turning in opposite directions.

To compare characteristics of high-speed propellers in Section 1, a formula is given that uses the generally available design factors: flying speed, brake horsepower and revolutions per minute of the engine. The coefficient found from these data is the speed power coefficient. For ready use two alignment scales are appended. In Section 2 a diagram shows that increasing the number of blades decreases the propulsive efficiency of the propeller. A three-bladed propeller will have an eight per cent larger diameter with a six per cent higher pitch and a four-bladed propeller will have a 14 per cent larger diameter with a 12 per cent higher pitch than a two-bladed propeller having identical blade designs.

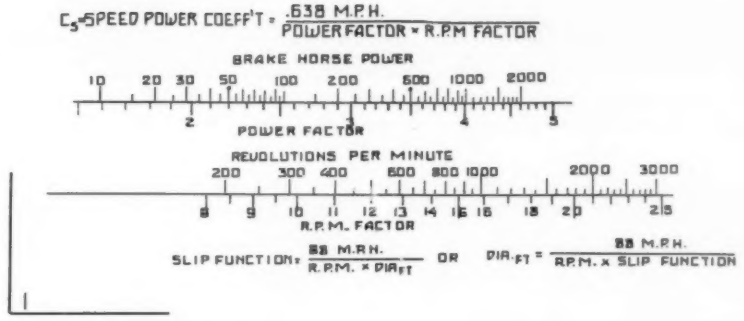
For the same solidity, however, the efficiency of a three-bladed propeller is higher than the efficiency for a two-bladed prop, as shown in the diagram in Section 3. The solidity (total blade width) is the ratio of the total blade area and the propeller disk area.

In Section 4 the speed power coefficients of two-, three-, and four-bladed propellers are plotted with their respective slip functions; all have the same blade layout.

An example will illustrate the working of the chart and the formulae: an airplane with an engine developing 900 h.p. at 2,200 r.p.m. has a top speed of 300 m.p.h. With the aid of the two scales in Section 1, the speed-power coefficient is found to be 2.2. The diagram in Section 4 gives, for a speed-power coefficient of 2.2, a slip function of 1.5 for a four-bladed propeller and a slip function of 1.3 for a two-bladed propeller—and a setting of 33° and 30° respectively. Using the formula in Section 1, the diameter for the four-bladed propeller will be eight feet and, for the two-bladed prop, 9.25 feet.

In order to eliminate rolling moment created by one propeller, a tandem ar-

(*Continued on page* 90)


C_S=SPEED POWER COEFF'T = .638 M.P.H. / POWER FACTOR × R.P.M FACTOR
BRAKE HORSE POWER
10 20 30 50 100 200 600 1000 2000
POWER FACTOR
REVOLUTIONS PER MINUTE
200 300 400 600 800 1000 2000 3000
R.P.M. FACTOR
SLIP FUNCTION = 88 M.P.H. / R.P.M. × DIA FT OR DIA FT = 88 M.P.H. / R.P.M. × SLIP FUNCTION
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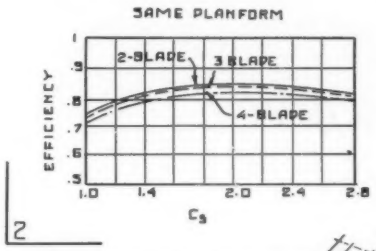
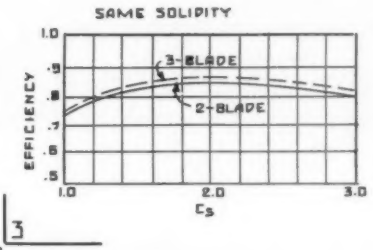
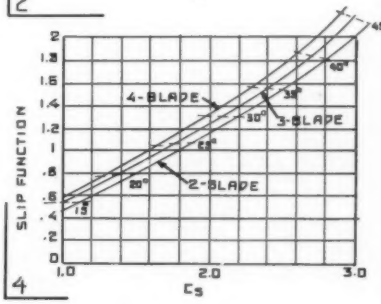
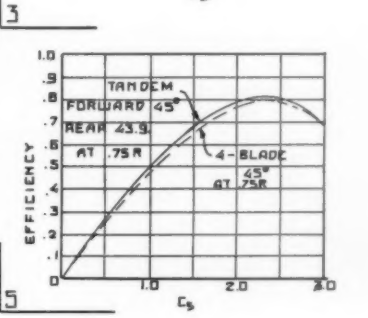
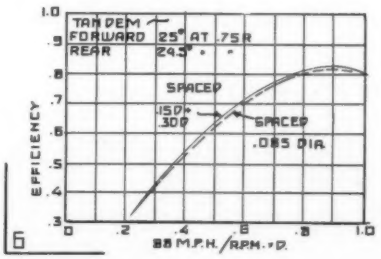
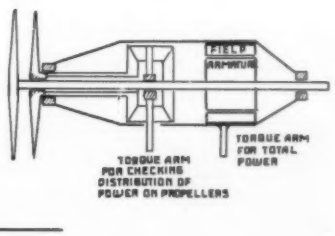


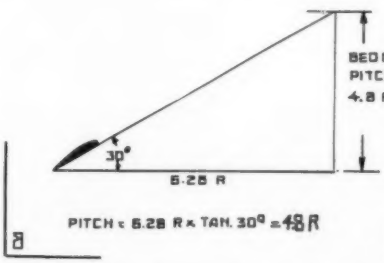


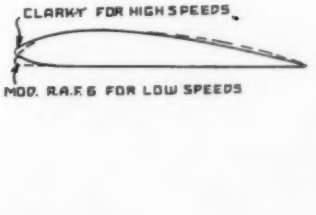




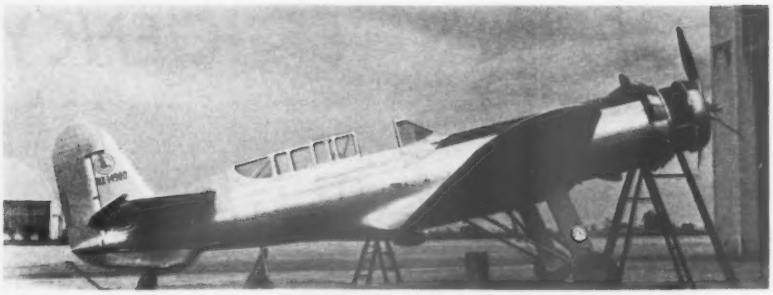






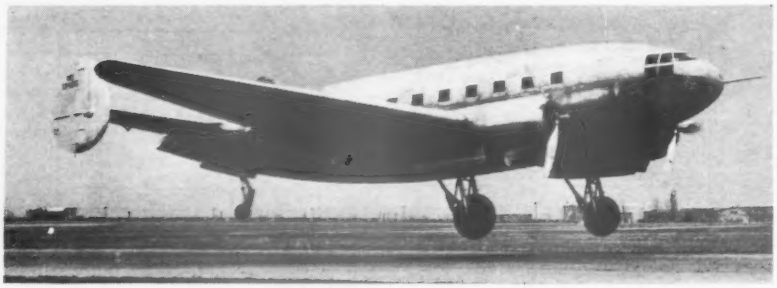


Engineers have worked out comparisons of various type propellers on charts.



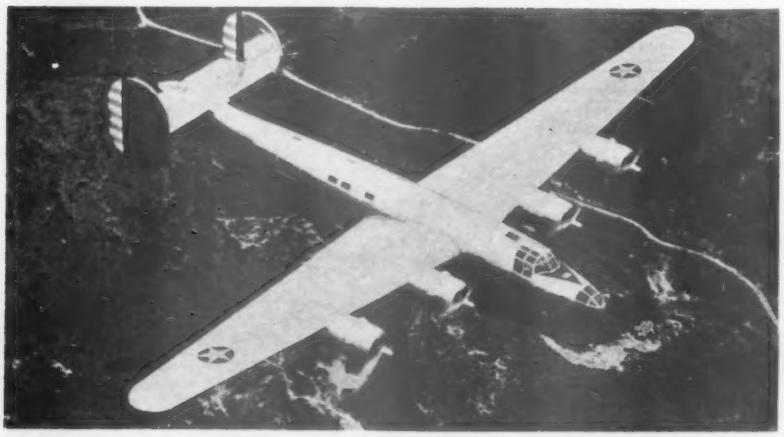
A novel revamping job was completed recently on an old Vultee scout-bomber with the above results. Ship was redesigned to accommodate 3,600 h.p. engine, giant propeller.

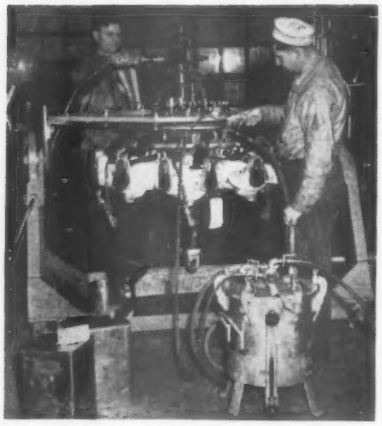
New biplane trainer is the Phillips CT-1, manufactured at Van Nuys, Cal. It is powered with an inverted four-cylinder, air-cooled engine that is rated at 120 h.p.



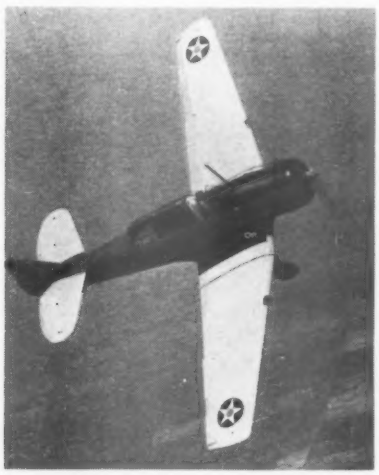
Latest airliner is Curtiss-Wright CW-20. Powered with two 1,700 h.p. engines it will carry 40 passengers at a top speed of 243 m.p.h.; 2,000 h.p. engines are optional.

Below is first flight photograph of Army's secret Consolidated XB-24 bomber. Engines are 1,200 h.p. each, gross weight 20 tons including 8,000 lbs. of bombs, speed 300.





Developed recently by a Coast Guardsman is this "engine preserver" shown above.

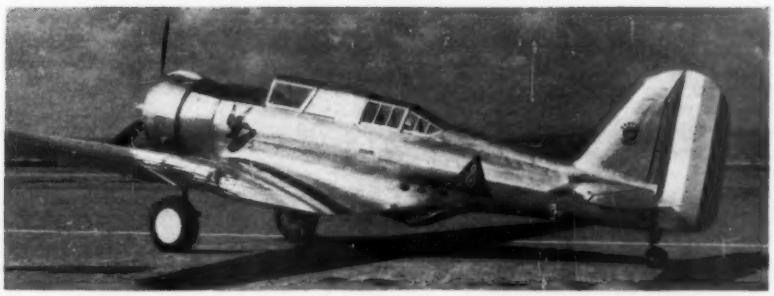


New Army trainer is the North American BT-14, now at Randolph Field, Texas.

A passenger on the S.S. Washington snapped this British plane as it investigated.

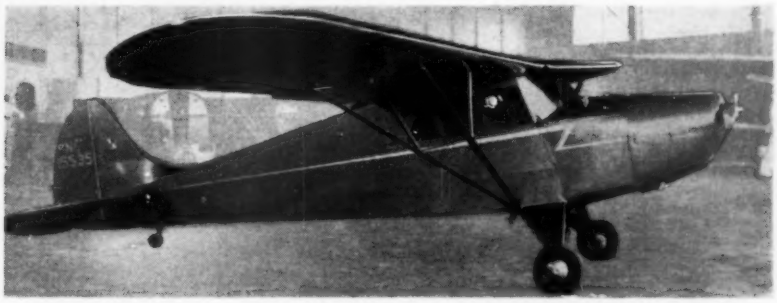
HAVE YOU SEEN ?

Soon to be delivered to Army is this Fairchild PT-19 trainer, 300 of which have been ordered. Engine is 175 h.p. Ranger. Commercial version, M-62, now has ATC No. 724.

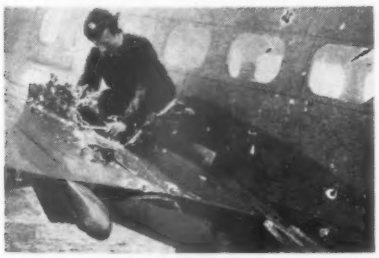


Fifteen Douglas 8A-4 attack-bombers like that above are being delivered to the Kingdom of Iraq. Its 1,000 h.p. engine gives it a top speed of 250, ceiling of 30,000 feet.

New Curtiss SBC-4's of Chicago Naval air base now bear squadron insignia designed by Popular Aviation's art department.



Now undergoing C.A.A. tests is this new "Cadet" lightplane built by the Interstate Aircraft and Engineering Co. of Los Angeles. Engine is 50 h.p., seating is tandem.



Unusual photographs above and below show damage done to British Lockheed "Hudson" by German anti-aircraft shell. The ship flew home on one engine, despite damage.

Interior drawing of latest model of the Douglas DC-4 (actually DC-6) shows passenger accommodations. Pan American has ordered 3, Eastern, 8; United, 10; and American, 15.

Skill To Order

(*Continued from page 43*)

bank Unified School System, California Apprenticeship Council, Lockheed company, and representatives of the employes.

"Potentially," said Mr. Irwin, "there is a great social benefit in this program as it is directed toward employment of young men between the ages of 18 and 23. A recent California state survey disclosed the fact that from 30 to 40 per cent of the young men between 15 and 24 have no jobs."

From the standpoint of the company, there was provided a long range source of skilled employes. The training program always had been a mass problem. Trade classes in the Burbank city schools were available to all Lockheed employes and today as many as 50 per cent of the day shift in many departments of the Lockheed factory go to night school.

There are 53 classes, attended by more than 2,000 students, in subjects ranging from elementary manipulative operations to advanced engineering. Trade mathematics, shop drafting and other related subjects are the most popular. These give a broad background of technical knowledge which enables an employe to adapt himself readily to new conditions and needs in an ever-changing industry.

In contrast, however, to this mass program, which we must admit lacks systematic selection of students and a long range target, Lockheed now has an apprentice program for the highly selective few, carefully scheduled to give a thorough background not in a single occupation but in a broad trade. This program is approved by the federal committee on apprenticeship and is under the supervision of the California state Apprenticeship Council, set up by the Shelley-Maloney apprentice labor standard act of 1939.

Preference was given to Lockheed's younger employes who have the necessary qualifications and who wished to take advantage of this training. Eventually as many as 200 young men may be working toward their journeyman's certificates. A union agreement limits the number of apprentices to one for every 10 journeymen. Due to the large number of applicants, no encouragement can be given at this time to applicants who do not live in the vicinity of the factory.

The apprentice must sign an indenture between himself and the company in which the terms and conditions of his employment as an apprentice are clearly set forth. The rules and regulations governing the apprenticeship have been prescribed by the Shelley-Maloney act of 1939 and the minimum working conditions are prescribed by federal laws governing a manufacturer engaged in interstate business and a contractor to our military forces.

Working details of the Lockheed program are in the hands of Svend Pedersen, apprentice supervisor, and the director of the education division of the Lockheed industrial relations department.

The apprenticeship covers four years and the work experience to be accomplished in the shop is outlined in a schedule contained in the indenture. In addition, the agreement requires that a minimum of 144 hours per year be spent in school during the term of the indenture. The subjects taught in school include trade mathematics, shop drafting, blueprint reading, materials and processes, technical English, operations and planning, safety methods and hygiene.

The work week consists of 36 hours in the factory and four hours of classroom instruction, a total of 40 hours for which the apprentice will receive full wages at his regular rate.

It is natural that apprentice wages should be somewhat lower at the start than the wages of other workers. However, that is made up by the close supervision, instruction on the job, variety of experience, school instruction, and other advantages which the non-apprentice does not have. It is stipulated that the starting wage of an apprentice without previous experience shall not be less than 30 per cent of the journeyman's or senior mechanic's rate as agreed upon by a joint apprenticeship committee. This committee is composed of three employes, members of the Aeronautical Mechanics of Burbank, Lodge 727, International Association of Machinists; three representatives of the Lockheed Aircraft corporation and one representative of the Burbank Unified School System.

As the apprentice advances in skill and ability, his wages advance according to the schedule of wage increases which is included in the indenture. There must be an increase of at least six cents per hour every six months for the four years.

The total term of apprenticeship is set at 8,320 hours, approximately four years. The agreement between the Lockheed Aircraft corporation and the Aeronautical Mechanics of Burbank states that "upon satisfactory completion of apprenticeship period, including both work and school instruction, the apprentice shall be rated and certified as a journeyman or senior mechanic in his craft."

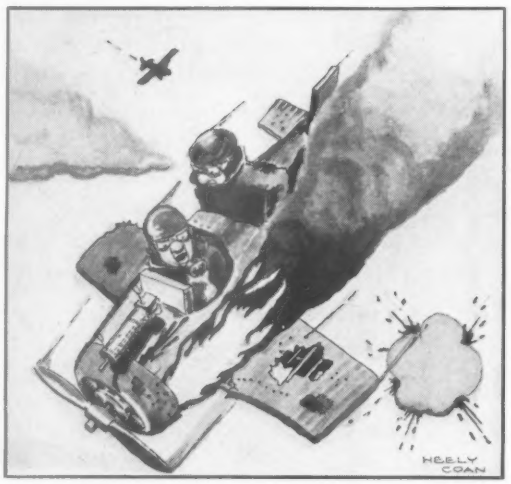
Crafts open to the young apprentice are the following: Aircraft machinist, aircraft tool and jig builder, aircraft wood pattern and wood jig builder, aircraft sheet metal apprentice, aircraft electrical trade, aircraft welder and metal fitter, aircraft painting and processing, aircraft upholsterer and trimmer.

A probationary period of 520 hours is allowed, during which either the apprentice or the company may change the budding aircraftsman from one trade to another in which his talents may better be employed to fit him for the development of his career as an individual craftsman within the industry.

"Industry in general suffers when there is a lack of all-around workers," Mr. Irwin explained. "Specialization is very well in its place and industry certainly must have its specialists, but it does leave many individuals 'out on a limb' if conditions change and there is no call for their particular type of work.

"In the Lockheed apprentice program the man is thoroughly trained not only as a specialist but in all phases of his trade. Thus he is trained not only to play his part in the building of better airplanes, but also in a more promising future for himself. He is building a place for himself in the industry.

"The all-around man I mean is not just the 'Jack of all trades, master of none' but the man who knows a few crafts well. The man who can go into a shop and do almost anything and do it right. That's the man who will not long be out of a job—and that's the Lockheed apprentice today. He'll be a good man tomorrow. He'll be good enough to get by even in the hardest economic periods for he is a craftsman, and craftsmen are seldom idle if they are willing to work regardless of dips in the business cycle."



"Calling headquarters . . . You wouldn't furnish us with parachutes, eh? . . . Well—we quit."

Our thoughts returned to the young man to whom we had talked on the day of Secretary Perkins' visit to the Lockheed plant. We know now that he had set his eyes on the stars. He intends to be a craftsman. He is willing to work and he does not intend to be idle. He knows he will have a place in the aircraft industry as a skilled craftsman during the coming years.

"See you in about five or six years," had been his jaunty "goodbye."

Yes, he'll be a good man tomorrow. He'll be "good enough to get by." And he will probably do a whole lot better than merely "get by."

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Test Engineer

(*Continued from page 31*)

He lives in Pasadena, reports at Downey, 20 miles away, at 7:30 a. m., rain or shine. After a day crammed full of activity he leaves the factory at 4 p. m., or later if an airplane is in the air. Leaving the factory does not get his problems off his mind. Probably he'll end up dreaming about them.

"Test engineering fascinates me," he says, "and it should fascinate just about every young fellow who looks forward toward a career in aeronautical engineering. And there's great opportunity with the industry growing under the stimulus of military production."

What will be his next job? Certainly, it will be advancement through the increase in size of his own department. Or he may move to a better paying position where his knowledge of flight operations will be valuable. But what it will be, nobody knows. That mushrooming of factories, as we have said, means larger departments, more departments, more and varied jobs almost with each passing day. As more and more ships are completed, Cheney and his associates find that not only is each model distinctive in characterists, but that it teaches them they have more and more to learn. One discovery leads to another. They need men with new skills and they need new instruments to make new tests of the discoveries they have made. For instance, the tests on each ship become more searching, more elaborate. Three years ago, Cheney worked alone. Today he has three assistants and all are struggling to keep up to the work at hand. Translated into your problem of unemployment, you'll be interested in knowing that in recent months three young engineers have applied for work and have been hired on their first jobs without leaving the factory after application! That's how men—trained ones—are needed.

What are the qualifications for a test engineer? First of all, says Cheney, an education is needed. Any applicant for any truly engineering work of any kind should be possessed of a degree in aeronautical engineering. If you have this and you enter a factory looking for work, you'll probably get a job. You'll be surprised, perhaps shocked, to find that you are offered a starting salary of $100 per month.

"What?" you gasp. "After all those years of college I find myself getting less than a good welder!"

That's all right. If you have the stuff the wages will jump fast, according to Cheney. You'll soon be getting a great deal more than the technical worker doing a specialized manual job. Today, an experienced flight engineer is making base pay of from $2,000 a year up. The men at Lockheed, Douglas and other factories who are flying tests are getting this much and more. Executive positions are just around the corner for most.

So much for salary. Remember, now, that you must have a degree first of all. And, second, any practical experience which you have had will stand you in good stead. A while ago Cheney brought up the point that the industry is advancing and expanding so rapidly that it is necessary to create new gadgets, such as the "photographic observer", new methods and what have you as you go along. At this point we have to draw the line between education and natural, native, normal intelligence. There are many men with degrees who would not make good flight test engineers. They must have education. *But perhaps they have too much.* Test engineers must correlate their data with a good portion of "horse sense". The data is limited because flying airplanes is expensive and tests must be accomplished rapidly. There are few established rules by which to go. You find that, for the most part, you have to be intelligent enough to make your own rules as you go.

"We are of the opinion that the engine is a bit too powerful for the plane."

"Another point," says Cheney, "theoretical education is fine. But you'll need the practical side. From 1931 until 1936 I attended the University of Cincinnati. During the first two years I majored in mechanical engineering. During the last three years I majored in aeronautical engineering. That institution is a pioneer in 'co-op' education. The idea is simply that the student studies for a month and attends classes. Next month he works at a regular job in an established business. As the average wage is about 50 cents an hour, it is obvious that the system isn't designed primarily to provide assistance for the student to pay his way to any great extent during classroom months.

"Its value lies primarily in the fact that the student learns to know and work with other men and apply his theoretical knowledge in a practical way. For instance, my first job was with a manufacturer of conveyors in Cincinnati. I learned almost immediately—when I saw college students called upon to do everything from making repairs on broken machinery to designing a new part—that college training was invaluable. The ordinary worker was able to cope with ordinary situations but when something new, different and unusual came along, the college-trained man was summoned.

"Later experience in the factory of the Aeronautical Corporation of America was even more valuable. One day I was working on a stress analysis, the next doing a drafting job, the next writing a news letter to plane owners or working on a cowling design. At that time—in the early thirties—the engineering staff consisted of the chief engineer, the engineer and myself. Later I worked in a butcher supply house as file clerk and blueprint machine operator. This varied activity doesn't all seem to have bearing on being a flight engineer, but I can assure you that every moment of every job was valuable.

"My advice is to start young to be an aeronautical engineer, whether or not you are aiming at a test job. I remember building model NC-4's at the time of their Atlantic flight—small models of paper and wood. Ever since then my career has been slanted that way. When you start studying to be an aeronautical engineer you are on the way to becoming a specialist. You won't be in a very enviable spot, as far as getting other work is concerned, if you change your mind half way through the long grind. You'll have to stick to it if you want to make the grade."

What about learning to fly to become a test engineer? Cheney recommends it. Most of his associates, he reports, have had some time at the controls. is experience has gone just a little bit beyond a solo. He'd have built up more time had it not been for the expense involved. Let him tell it:

"During the summer of 1928 I barnstormed with a flying circus using three OX-5 Travel Airs," he says. "I didn't fly, but I observed a lot. In 1929 I hitch-hiked from Minnesota to Dallas, where my father was managing the Love Field branch of Southern Air Transport. I worked as field steward for the airline and Dad gave me time in a Fleet. One day he walked away and told me that as long as I'd been doing all the flying myself, I'd better take the ship around alone a few times. I've been too busy and too broke to continue my actual flying career since that time. But I'm glad for my experience flying with my father and my own short session at the controls as I climb into a Vultee. I feel

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at home, know in advance what the pilot will do and can figure out all maneuvers quickly and easily."

How did Cheney actually become a test engineer and how can you follow in his footsteps? First of all, after finishing at Cincinnati in 1936 he spent the summer at a R.O.T.C. camp. In the fall he drove to California He heard that Glendale was a flying center so when he arrived he found a furnished room there. He started looking for a job immediately. His first call was at Lockheed, where he filled out an application blank and learned that there might be something immediate at Douglas. He saw the personnel manager at Douglas who, in turn, sent him to Vultee. After an interview there he won his first job. The elapsed time was about ten days from first application to payroll. Cheney says that there is no reason why any other young man, similarly equipped, cannot do the same thing today.

He tells of many instances of young men who have applied at various factories to be employed immediately.

His first job was to do a stress analysis on the landing gear of the previously mentioned Turkish attack bomber. He was still working on this when flight tests were started on the Vultee V1A which had been built for William Randolph Hearst. Luck and circumstances now take hold—luck, because there was no department then at which to apply. You, in seeking work, will find your department already established and expanding. Up to this point it is quite obvious that there are plenty of jobs open in aeronautical engineering departments for men with training—and that means you if you have learned both theory and practice.

At 27, Harold Cheney—born in Packard, Ia., April 24, 1913—is one of the youngest men employed in one of the most thrilling of new professions—that of flight test engineer. He comes by his job naturally, for his father is the famous Clair Cheney, veteran barnstormer, now flying for Tobin Aerial Surveys at San Antonio, Tex. A younger brother is a Naval Aviation Cadet at Pensacola, Fla. Harold made his first flight at the age of eight in a post-war barnstorming Jenny. His father was at the controls. Harold sat on his mother's lap.

The elder Cheney moved around considerably in those dear, dead days of infrequent profit, chasing hops at so much per head and selling automobiles, brushes and real estate when he ran out of flying customers. Harold grabbed an early education in Iowa and Florida. He went to high school in Grand Forks, N. D., Crookston, Minn., and finally was graduated in San Antonio. He got an A.E. degree with top honors at the University of Cincinnati in 1936, drove his car to California. Then, without pull or influence of any kind he landed at Vultee Aircraft, Downey, Cal., in just 10 days. He confesses designing his first airplane of two old boards while his father was flying World War planes back in 1918, and he was approximately five years old. He is unmarried.

Cheney has spoken of the fact that aeronautical engineering work is empiric and has stated that engineers are constantly working into new fields, finding and solving new problems. The young man who applies for a position five years from now, therefore, will have to know a great deal more than today's applicant. That's how fast engineering advances are being made.

One day Cheney was assigned to the job of going along with Test Pilot Alan Russell in the V1A. He gulped, said that he was ready and pretty soon he was at 18,500 feet looking at the potentiometer, which was connected to thermocouples on the engine, and recording temperatures. This test job lasted a month.

Next he was sent to the confidential design room to work on the *Vanguard* pursuit. This crowded out other activities. Soon he was doing the aerodynamic research and planning the test program for the wind tunnel work at the California Institute of Technology. Under the chief designer he handled these tests and wrote the resulting aerodynamic report. Just to show you how a job grows these days, during the latter part of the push on this job he was aided by five assistants.

"Late in 1937," he relates, "I was summoned to the offices of the late Gerard Vultee. I met Turkish military representatives and was informed that contract tests would be run on the V11GBT for them, the object being to prove the performance of the ships to be as we had promised.

"I was told to handle the flight engineering. The ships met the specifications. During this period I dropped everything else. I spent a lot of time studying flight test procedure. It will be to your advantage, no matter how rushed you are, to look up everything you can find in connection with your job. There won't be much, because there hasn't been much time to put the information in written form, but you'll find something worth while."

From this time on out Cheney has been a flight test engineer exclusively. His job has been increasing in scope with the increasing responsibility. He has had several increases in salary and has been given his present title.

How can you follow Cheney's course into a job like his?

"Well," says Cheney, "you can't do it the way I did because I got into the factory and was at work before my department was started. Your angle on the job, right now, with all major companies using flight test engineers and developing these departments, is easier than mine. For you have something to shoot at.

"The best way to do it would be to apply for a job at any of the big aircraft companies specifying a preference for

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flight test engineering. You should be satisfied with any engineering job, just to get inside and be at work. Then should follow a period of meeting the men in the flight testing department and learning all that you can about the job. Generally, a man who 'slants' himself toward any particular type of work by preparing himself will land there eventually."

Cheney says not to be upset about any work which you do in the course of getting your education. It was hard, at the time Cheney worked for the butcher supply company and sold tools in a store basement, to see what these jobs had to do with aeronautics. But every experience, he holds, has proved itself applicable to later work. The main thing to remember, always, is to get the practical side. You must work with men and learn to know them and how they work if some day you will become an executive.

Cheney often hears executives under whom he works say:

"It's hard to find men who are able to adapt themselves to new situations and problems. They do not have enough constructive imagination. They do things only as routine. They don't have the ability to figure out how to get the information we need—the information which will give answers to our problems."

"Lastly," says Cheney, "any man entering the industry should have an ability to gamble, or the gambling instinct."

Most of our industries have steadied down for the long pull. Aviation hasn't. It's a wide open field and you still have that feeling, Cheney says, that "a man can go any place and do anything he wants to, depending only on his ambition and his ability."

END

Airline Mileage

THE United States has, within its continental borders, 39.7 per cent of the world's railroad mileage, 53 per cent of its paved highways but only 7.2 per cent of its scheduled air routes. But the U. S. can also claim credit for airlines operating in Latin and South America, Alaska and across the Atlantic and Pacific oceans. This brings the American total up to 27.1 per cent. Total world mileage for scheduled airline routes is 499,300; route mileage for airlines within the United States is 35,900.

Pre-fabricated Models

MODEL airplanes that can be built of pre-fabricated parts in one-tenth the time, have been developed by scientists of the Washington Institute of Technology of Washington, D. C. An ingenious production method makes possible the pre-fabrication of fuselage sides, top and bottom, wing structure, and control surfaces. Assembly methods approximate those used in real ships.

Flivver Rescue

(*Continued from page* 25)

Feathery, clogging snow covered every available foot of the school ground—the only open space that could be even considered as a landing spot on Smith Island. The big planes wheeled doubtfully around the little mile-wide islands where the people waited hopefuly for succor. Finally, they reported back at their base that only a small, very short-landing plane could possibly get in.

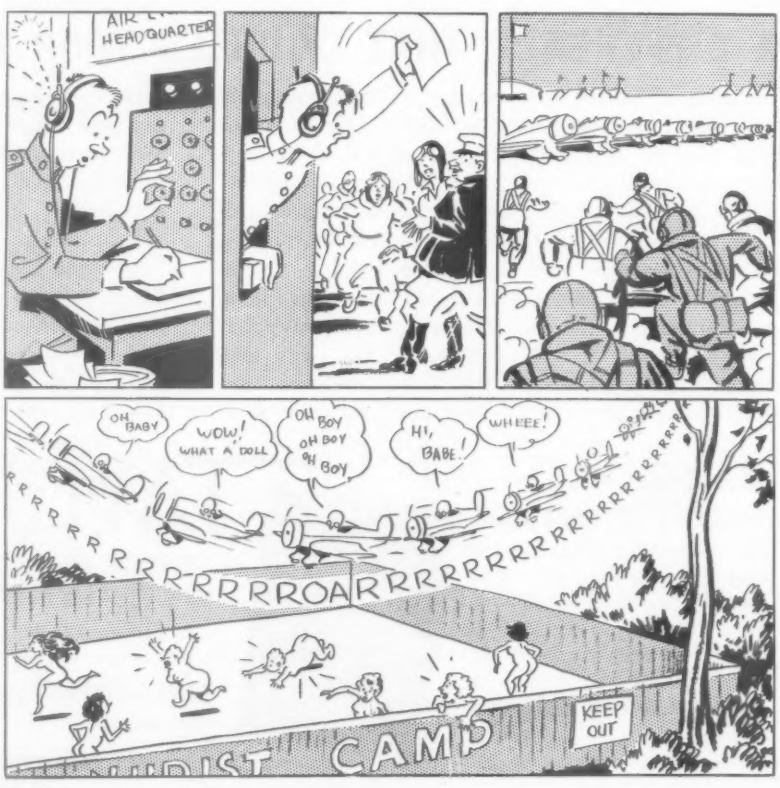
No milk had been delivered for 10 days. No doctor or nurse was numbered among the 800 population and under the circumstances of isolation in the blinding cold, sickness might strike fatally at any time.

Fred Ennis of Salisbury, Md., studied the Coast Guard reports carefully. Possibly a lightplane could get in where the bigger, faster ships could not. His *Cub* on wheels, would sink to the belly in the soft snow. But if John Hinson would bring down his ski-equipped *Cub* from Rutherford Field, near Baltimore, perhaps they could make some successful contacts. . . .

They took off early in the morning in Hinson's plane. Besides the two men the ship carried 40 quarts of milk; although mail was piling up at the mainland they decided not to load the ship too heavily for its maiden flight. As the Coast Guard had reported, the school yard was clear, but a number of obstructions cut down the available area and snow was drifted badly. Out in the open bay the ice was too rough for skis which sometimes can ride over a lot of rough terrain if landed "toes-high". A small cove seemed smooth, but a number of ships were frozen into the ice with their masts providing an added hazard. Several times they wheeled around the island. They could see groups of people gather at the cove. If they could get down among the masts they could make it—unless they should coast into a boat. They decided to try it.

Wheeling and sideslipping in the hazardous approach they came down to an uneasy landing in the high wind. The crowd rushed out. Willing hands grabbed the wings, pulled the ship to a stop.

Ennis and Hinson made several trips that day and the days following. The islanders were not the only people feeling the grip of winter. Out in the bay the *Lilly Ann* was having her troubles. Locked in the ice, the crew radioed that the ship was beginning to break up and they were unable to break a way through the ice. A Coast Guard cutter was trying to cut through, but was coming too slowly to suit the worried sailors. "There is a channel through here somewhere," the operator reported, "and if we could stay in it, we could break a way out for ourselves, but the ice is so broken and jumbled that it is hard to follow." Ennis and Hinson roared out to see what could be done. Flying high, it was easy to make out the channel of thinner ice where the course originally had been broken when the ice was less threatening. They swooped down over the *Lilly Ann's* bow and



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pointed the way. Butting its icy prison, the ship nudged the ice aside and slowly and tortuously followed the course the *Cub* indicated as it swooped, dove and climbed away again and again.

For nearly a week milk and mail was carried in daily to Smith, Tangiers and other little isolated isands dotting the white desert of the bay, without any particular incident. Then trouble struck in a deluge. Harold Evans, eight, was desperately ill, said the radio message. Would Ennis or Hinson bring in medicine and a doctor?

They took off on skis carrying first aid with promise of more help and were met at the island with another SOS. For three nights the Great Shoal Light had been out. Either the lighthouse was giving way—and the Coast Guard had reported some dangerous trends along the tributaries into the Bay—or the keeper was ill. Would the pilots fly out and see if they could find out what was wrong? It was late, but the two self-appointed guardians of the East Shore looked at the darkening sky and wheeled out on their mission.

Not a sign of life could be seen around the stark white column of the lighthouse. For a quarter of an hour they circled low, zooming past the windows and looking in vain for the keeper, Henry Bradford, a Coast Guardsman substituting for the regular keeper. Back at the mainland they reported that so far as they could tell from an aerial check the lighthouse was holding up all right, but the keeper must be ill or injured and the ice was too rough for a landing. A blimp was mentioned but at last the Coast Guard cutter sliced its way through to the man who was found almost helpless in bed. Given first aid on the tender he was removed to the MacCready Hospital at Crisfield. He had been extremely ill for three days with nothing but his darkened light to signal the villages in Somerset and Wicomico Counties of his plight.

It was dark when the two pilots reached Salisbury, but Smith Island was calling again. The *Island Belle*, the Smith Island supply ship frozen in the ice since the first bizzard, had tried to break a path through to reach the channel cut out by the Coast Guard. But a mile from home it had given up. Another ship had started from Crisfield but had to give up, too. Young Harold Evans was fighting death now. His appendix had ruptured. He must be gotten to the hospital immediately. The boats couldn't get through. Would the pilots try another trip?

They started at dawn. A 35-mile wind was lashing the bay and the landing among the masts loomed ahead, but Ennis fought the lightplane through the gusts. One advantage he had as he reached the little cove. With the gale on his nose, the little *Cub* sat down shorter than an autogiro when he throttled back. A dozen men grabbed the wings as it staggered to the ice, hung on to struts, wing tips, and tail while the child was bundled into the wildly rocking craft, snugly wrapped in blankets.

Ennis gunned the motor until the little plane surged against the hands of the men holding it down. He signalled for release and, free of the restraining hands, it fairly leaped into the air for an almost vertical take-off against the gale. He set the nose of his plane for Crisfield and roared off through the storm. There was no place close to the hospital to land that could be reached easily by an ambulance—and time was precious. The road had been cut out though through the edge of town and the ambulance was drawn up at the foot of the drift bordering the highway. Ennis sat down in the snow-drifted dooryard nearby, taxied over the buried fence to the brink of the road and Harold was lifted down for the last leg of his dash to MacCready Hospital.

Such times know no rest when you are the only man who can reach such points as the storm-bound islands. Crisfield was already hunting Ennis or Hinson. Frank Dize, Tangier Island oysterman, had been missing for sometime. Either his skiff had capsized in the gale or he was locked somewhere in the ice. Blankets and food were loaded into the plane and once more the rescuers started out. If he were in broken ice a landing would be impossible. But if the supplies were dropped to him perhaps he could exist until the Coast Guard cutter could reach him. Near Tangier Light the pilots located him toiling through the shifting floes. They swept low. Dize waved them on. Here the ice was broken enough so that travel was possible, though slow, and the islander needed no help. The flyers scanned the drifting floes, picked a course that seemed easiest for the boatman to follow, pointed it out with a few zooms and returned to Crisfield with the encouraging news.

Within the next few days, conditions seemed to be clearing. Ennis continued carrying milk and mail into the villages and the Coast Guard still was barging stubbornly through the ice, breaking paths. Ennis confidently reported on February 2nd that his trip that morning would be the last. Then—a woman on Smith Island had had a heart attack and needed medicine. A physician and Ennis left Salisbury airport only to land at Smith in a blinding snowstorm. He set his plane down safely but reported back by the island's radio that he would be unable to take-off until the storm cleared. Wind and colder weather again brought desolation. Snow drifted over the windswept ice and Ennis, who was again flying his own *Cub* on wheels, had a hard time taking off the next day. But food and medicine were needed at a number of islands and several people who had gone to the mainland by air earlier in the freeze insisted they must get home. Shuttling back and forth Ennis tried to answer all calls. Ralph Brimer, 12, was struck down suddenly by a ruptured appendix and was whisked off to the MacCready Hospital to a bed adjoining his playmate, Harold, who had been carried in by Ennis eight days before. Ralph's parents and his minister were carried to his bedside before darkness fell.

That was the last of the "headline flights", but ferry service of food, medicine and worried islanders continued. One Sunday, 20 were lined up at the Salisbury Field seeking rides home. As it happened, none of that group had ever been up in a plane but all were too anxious to get home to give that a second thought. One at a time, they climbed into Ennis's or Hinson's plane and were carried home. A hundred and forty pound load of mail—the final load, which turned out to be mostly mail order catalogs—was delivered.

Conditions began to improve. The breakup was rapid when it came. Ships began to nudge through the ice and once more the islands linked their lives with the mainland in a routine isolation broken by reasonably quick contact when needed.

Routine isolation—but quick contact. That's why today, as summer comes to the East Shore, the village fathers on Smith Island are looking over the school yard with appraising eyes. Three hundred feet of the marsh can be filled in at the end, they have decided, and with

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200 feet available in the school yard itself, a 500 foot runway is possible. They admit it won't be the best field in the world, the approach won't be completely clear and 500 feet is short for a runway. But, since Ennis and Hinson kept them in touch with civilization in the big freeze, they have every confidence in the ability of the lightplane to get into their little field. The mercy flyers had a scant two hundred feet in the cove they used.

That's why, too, an Aviation Day with a real purpose is being planned for this summer. As remarked upon in other emergencies, people forget to be afraid to fly when it is really necessary. But when an emergency has the village already worried to desperation, why make it worse by shoving a new experience down their collective throat? So a young armada of eight or 10 planes will come in some time next summer under the direction of Hinson and Ennis and every villager, young or old, is to have a ride. The community-owned airplane is only a dream cherished by a few—but a definite possibility. The isolated island will not be cut off again if the islanders have their way. Aviation has come to the East Shore.

END

Fenced Factory

THE Vought-Sikorsky plant of the United Aircraft Corporation, at Stratford, Conn., has been surrounded with a high wire fence, topped with heavy barbs, at the instigation of Army and Navy Intelligence Departments. The fence was suggested as a precautionary measure to prevent sabotage and espionage at the aircraft plant which is engaged in filling orders and doing experimental work for both the Army and Navy.

Stalls and Spins

(*Continued from page 15*)

"Slots? No. Perhaps, in view of the success of the new fixed wing-slot pioneered in transport design by Lockheed, this comes as a shock. However, although it is valuable in larger ships and even in light airplanes, I believe I can design an airfoil which will have excellent stalling characteristics—so good, in fact, that slots will not be necessary."

Today engineers know a great deal more about the stall and spin than they did only a few years ago. The large free-spinning wind tunnel at the Langley Field laboratory of the National Advisory Committee of Aeronautics and other equipment in research laboratories throughout the nation have assisted in solving the problem. In consequence, we have several airplanes now flying that have excellent stall characteristics and for all practical purposes are spin-proof.

The development of spin-proof, stall-safe airplanes, however, has not been as rapid as conditions appear to warrant. At the same time, the accident record of the past few years is evidence enough that airplanes with these characteristics are desirable. Approximately 50 per cent of the fatal aircraft accidents involve the spin or stall and the airplanes concerned are still being manufactured with the same characteristics.

Designers have improved airplanes in respect to their flying comfort, speed, beauty and some of their handling characteristics, but only a few manufacturers have effectively dealt with the problem of eliminating objectionable stall and spinning characteristics. Regulations prescribing desired spin characteristics of airplanes submitted to the Government for approval were written by the old Aeronautics Branch of the Department of Commerce and, with very few modifications, are the same regulations that now appear in the Civil Air Regulations. These regulations require that the airplane recover from a six-turn spin within 1½ turns after controls have been neutralized. Inasmuch as the spin characteristics might be adversely affected by a rearward movement of the center of gravity, tests are conducted under maximum rear load conditions. Correlated regulations guard against a later shifting of the center of gravity which might be caused by overloading the baggage compartment or by the installation of radio or other auxiliary equipment. These varied loading conditions might change the center of gravity and have a dangerous effect on spin characteristics without necessarily exceeding the gross load limitations of the plane.

The effect of these regulations has been to raise the spinning standards of all aircraft to the minimum established. Once attaining this minimum, however, engineers apparently drop the problem as being solved. Too many times such minimums become maximums and development stops. Yet all manufacturers have not considered this minimum as a maximum and, in at least one case, attaining the minimum resulted in the development of a plane that was to all practical purposes spin-proof and had excellent stall characteristics. The story of this development is somewhat as follows:

The production of a new small plane was delayed when it was learned that it would not recover from a six-turn spin until after making 2½ additional turns. Engineers immediately went to work to solve the problem. During the course of the research and testing, the plane was spun approximately 2,000 times until finally, due to progressive slight changes in design, it would not spin—just 2,000 spins to end all spins.

Other planes have been produced within the last year or so that have been proof against the inadvertent spin and have had excellent stall characteristics. But the spin-proof airplane is not a development of the last few years. During the last decade several airplanes have been produced that had excellent characteristics in this respect. Expense, unconventional design and maneuvering limitations apparently deterred their acceptance by old pilots and possibly explains the reticence of other manufacturers to attempt incorporation of some of the features in their designs.

In further defense of the manufacturers, I realize that in the past airplane design was influenced by the theory that the airplane which was hard to spin was hard to recover from a spin. Designers purposely designed airplanes to spin easily bearing in mind that they also must recover easily. This theory and practice of airplane design not only was accepted by the industry in general, but Government regulations had the effect of imposing it upon them.

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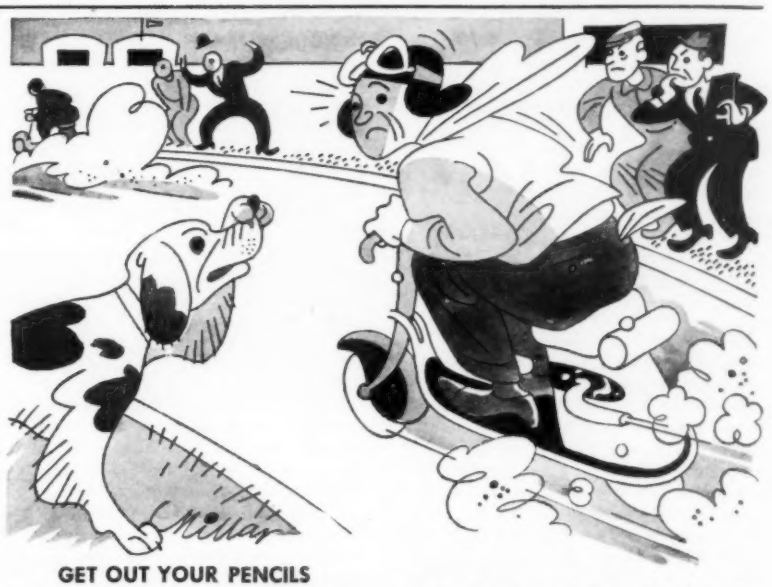

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THIS MONTH'S WHOPPER

Dear Major:

The other afternoon I got entered (don't ask me how) in a scooterbike race over at the airport.

The hour arrived. All twelve competitors were at the marks. The pistol went off. We started.

Right at the beginning I was passed by a roar on my right, then a roar on my left, till all the other racers were way out in front.

I was discouraged. The bystanders booed. Even a large pointer sitting beside the track shook his head in disgust as I passed.

The second trip around found me still further behind. Being booed by the spectators was bad enough but being ridiculed by that dog got me. I dreaded to come around for the third time. Then there I was . . . but instead of sticking out his tongue at me, he was pointing.

That got me. For the next seventeen laps, I tried to figure out what that dog was trying to tell me. Finally it came to me.

I hopped off the scooterbike and dashed for the Gulf Aviation Gas truck at which he'd been pointing. I grabbed a hatful of G.A.G. and rushed back to my bike.

Major . . . so help me, when I stepped on the gas again, I passed those other bikes so often the fellows keeping track on the sidelines lost count of the laps. I was going so fast that the grass kept catching on fire and the spectators had to forget about watching the race and stamp it out.

I continued gaining laps and picking up speed. Until, first thing I knew, I looked back and there was the front end of my scooterbike coming around the bend behind me. The speed actually increased till I got close enough to give myself a kick in the pants—*for not using G.A.G. before!*

Jerry Cunningham

Gulf Oil Corporation and Gulf Refining Company . . . makers of

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few years has changed conditions. Now we can have safe airplanes that are spin-proof and stall-safe. Why should not the spin be eliminated? Spins serve no useful purpose nor are they necessary in any manner whatsoever. There is no need to give spinning airplanes to the private flyer and force upon him the attendant dangers and the necessity to attain the skill required to safely fly this type of plane when spin-proof airplanes can be built.

Although up to the present time the development of airplanes with spin-proof, stall-safe characteristics has been relatively slow, the Air Safety Board anticipates a period of rapid change in the near future. No less an authority than Dr. Vannevar Bush, chairman of the National Advisory Committee for Aeronautics, testified last December before a committee in the House of Representatives:

"A research program is under way leading to the development of a private-owner type of airplane that will have greater inherent safety, in that it will be spin-proof. The results are encouraging and we hope that by this time next year there will be a number of airplanes available which can properly by called spin-proof."

The Board's study of spin and stall accidents extends back to its early days of operation during the fall of 1938. As a result of its studies, the Board transmitted a report to the Civil Aeronautics Authority in July, 1939, in which it recommended the recertification of instructors and action by the Civil Aeronautics Authority to encourage or require incorporation of built-in safety characteristics in the basic design of future light airplanes which would make them inherently difficult or impossible to spin or stall.

As previously mentioned, studies conducted by the Board show that approximately 50 per cent of current fatal accidents involve the spin or stall. Most of these accidents originate in maneuvers at an altitude of less than 1,000 feet and usually inexperience or lack of skill of the pilot is an important factor. Although this kind of accident is aggravated by show-off or reckless flying, even this type of flying would not result in so many fatal accidents if the planes used were less subject to spins and dangerous stalls in which several hundred feet are required for recovery.

Let us examine a few types of spin and stall accidents in which the accident might have been avoided if the airplane inherently had been safer. Numerous cases are on record in which the pilot attempts to stretch a glide or makes a flat turn to get into a field after an engine failure. The maneuver results in a stall followed by either a spin or a dive into the ground. A number of similar instances have occurred in connection with steep climbing turns on the take-off.

Another representative incident is the case in which a pilot flew within a couple of hundred feet above his home, throttled the engine and concentrated his attention upon waving to his mother. Although the pilot was flying straight and level at the time, he permitted the plane to stall and it spun in before recovery could be effected.

In most of the foregoing accidents inexperience was an important factor, but our records contain similar accidents in which instructors and other experienced pilots have been involved. There is one case in which a pilot with several thousand hours' flying time attempted to squeeze into a small field. He lost too much speed during the last turn in his approach and spun in.

Flaps offer a tremendous improvement in certain handling characteristics of airplanes, particularly when used by a skillful pilot—but they also have increased some of the hazards of flying. Some airplanes equipped with flaps can be used by the inexperienced pilot with absolute safety; but too many are in a dangerous category. The flap-equipped planes in the dangerous category might offer some excellent landing and take-off characteristics, but they also have increased stall and spin hazards. With flaps down and power off, the nose has to be kept quite low and care must be exercised during turns or the pilot invites trouble. If the accident rate is to be decreased, flying must be further simplified for the private pilot rather than made more complex. Skill, judgment and vigilance must not be such important factors to safe flying.

When the Board first undertook the problem of preventing the recurrence of spin and stall accidents, the project of first importance was the recertification of instructors and the installation of standard training procedure. With this accomplished, new pilots would have the basic training necessary to fly present equipment safely. It was a project of both the Civil Aeronautics Authority and the Board. Results have been promising, but the Board realized from the first that complete safety in flying was dependent not only on a high average pilot proficiency but upon a degree of individual control that it was not practical for the Board to exercise over private flying.

The solution of these problems would be assisted by the development of spin-proof, stall-safe aircraft, for then the necessity of developing highly skillful pilots would be eliminated and the importance of the judgment factor in safe flying would be minimized. Investigation by the Board has disclosed that not only are spin-proof, stall-safe airplanes available, but in most cases slight changes could be made in existing airplanes at little financial expense which would result in improving their stall characteristics greatly and make them less vulnerable to spin.

We have had a pretty fair example on the airlines of what safety will do to encourage wider popular use of the airplane. The operating companies are now in the fortunate position of having more business than they can properly accommodate and practically all of them are placing large orders for new equipment. Thus, the situation seems to resolve itself into a valuable precept as to what to do in order to popularize the airplane with the general public as a safe and easy means of personal transportation.

The Board believes that a little bit of careful thought in the design and construction of airplanes which will require less skill and judgment on the part of the pilot to operate not only will eliminate a large share of present day accidents, but also will make the private airplane more marketable by making it more attractive to a larger number of people.

END

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The Deadly Show-Off

(*Continued from Page 35*)

demonstrated, in the saddest way possible, that the manufacturers of lightplanes are justified in considering their little products structurally safe when properly handled, but warn that there is a limit to what any airplane can take. This boy, who had a passenger with him in the almost inevitable violation of regulations, climbed his little ship to 3,000 feet and began a power dive. After about 1,000 feet he terminated the dive with a violent snap roll to the right. The left wing failed, with a loud report and both pilot and passenger were killed. He had gambled on the airplane taking more than even its manufacturer claimed for it—and lost.

A student pilot in Georgia killed himself and seriously injured his passenger last summer in exactly the sort of accident in which a friend of mine, an Army pilot with World War service, lost his life. The Georgia boy was circling the airport when the engine failed. He began a glide toward a cleared field but, when the airplane was about 15 feet from the ground, the engine started again. Instead of going on in, landing and finding out what the trouble was, the boy immediately began a steep climb. As the airplane gained altitude, the engine cut out again. The ship stalled and hit the ground just as it began to spin. The Air Safety Board found the accident's contributing factor was "carelessness of pilot in starting a flight without sufficient fuel."

The Air Safety Board has no statistics available which give the exact proportion of fatal accidents caused by show-off flying to all the accidents in non-scheduled aeronautics. But it seems obvious from a study of the hundreds of accident reports that the proportion is very high.

Of course, many accidents resulting from steep turns at low altitudes and steep take-offs—plus inexperience and carelessness under other conditions—could be eliminated at the source if manufacturers would build ships that won't spin or stall. Officials of the C.A.A. have pointed this out many times and the trend already is toward that end. Three manufacturers now offer ships that either won't or are extremely difficult to spin or stall. The Engineering and Research Corporation airplane, built according to Fred Weick's design, absolutely will not because I've tried it myself and know it won't.

However, Weick and many other authorities have pointed out that a 100 per cent fool-proof airplane can't be built. Anyone can build a ship, the design of which tends to minimize the danger of a fool at the controls. But they all remind you that, as long as the ship will fly, it can be flown into power lines, houses and other obstructions.

An example of that is provided by the Air Safety Board in their investigation of an accident in Texas in which the pilot—as usual holding a student permit—was injured seriously and the passenger was killed.

"The pilot flew low over the homes of several of his relatives," the report said in part. "The pilot dived and zoomed the aircraft several times at extremely low altitudes, estimated at between 50 and 100 feet. After zooming over the house of his sister-in-law, the aircraft continued for a short distance and disappeared in a dive behind some trees . . . the aircraft was completely demolished . . . The probable cause of the accident was: inexperienced pilot lost control of the aircraft while engaged in acrobatic flying at low altitude." Obviously this accident could have occurred no matter what type of airplane he was flying.

A similar accident involving still another, but fortunately comparatively infrequent, factor killed a California pilot who held a private certificate. The pilot, says the report, was "engaged in acrobatic maneuvers, consisting of dives, zooms and wing-over turns, at extremely low altitude over a thickly populated residential and industrial area." He zoomed and then made a wide turn, in which the airplane lost altitude rapidly in a side-slipping attitude until it struck a power line. The safety board said the pilot lost control of the airplane while executing acrobatic maneuvers at low altitude—and that he had been drinking.

Tom Hardin and C. B. Allen, chairman and vice chairman, respectively, of the Air Safety Board, have very definite ideas on how the reckless, the careless and all the others who go under the general heading of "The Deadly Show-off" best can be curbed. Bear in mind, of course, that the board only investigates accidents for the C.A.A.; the regulation of pilots is the Authority's duty. However, the officials of the body investigating the accidents certainly have some sound ideas on preventing them.

"There are two general ways in which to discourage show-off flying," they told me. "One is by prompt, impartial and rigorous application of penalties for infraction of the Civil Air Regulations, and the other is by concerted effort on the part of flight instructors, private flying organizations and individual pilots to discourage the hare-brained show-off of aviation.

"The C.A.A. already has made a good start in the first direction and we believe that their prompt action in suspending and revoking licenses and imposing other penalties for flagrant infraction of the flying regulations is having an extremely salutory effect. Unfortunately, a comparable degree of activity has not yet manifest itself along the second line of approach to this problem and a lot of missionary work is needed to get such a movement under way on a nation-wide scale."

"How do you think student pilots can be stopped from carrying passengers?" I asked them.

"Practically the same answers apply to this question. The practice of student pilots carrying passengers could be solved to a large extent if the C.A.A. were to adopt the recommendation made by the Air Safety Board last summer that solo flights by pilots possessed of student certificates be restricted to gliding distance of the airport from which the flight originated and that all such flights be under the personal supervision of a certified instructor."

"Many cases of carelessness or deliberate violation of regulations by student pilots," I reminded them, "take place on the airports where they learned to fly or are learning. Do you think their instructors should be held at least partially responsible for their conduct, inasmuch as their having soloed them in a sense put the seal of approval on their flying ability and manners?"

"We feel that instructors should be held more responsible for the conduct of their students after solo than they are at the present time, so your question gets an affirmative answer," they said.

I expressed the belief, shared by many observers of the situation, that the Civil Aeronautics Authority is hampered by a lack of personnel and that more inspectors might be helpful in reducing the number of accidents.

"An increase in the number of C.A.A. inspectors should contribute to a decrease in the fatal accident ratio," they agreed, "because it would bring about more adequate supervision or policing of flying activities. There is, of course, some happy medium limit in this sort of thing; the absurd extreme would be to have an inspector for every pilot. Here again, most of the policing of the

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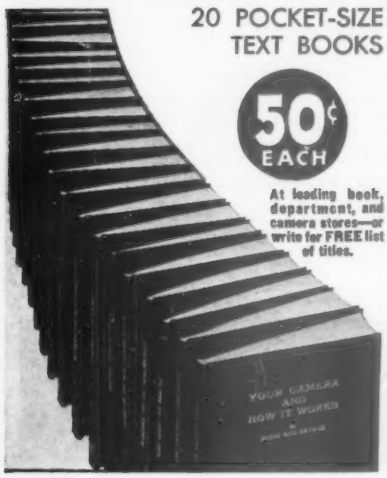
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industry should be done by itself."

Many flying schools and airplane rental service operators have given the problem serious thought, realizing that every accident has a harmful effect on their business. The commercial operators belonging to the Maryland Flying Club recently took a step which is exactly what the Air Safety Board suggests.

These men issued an announcement that any student or pilot renting an airplane, who was reported for recklessness or any other show-off tactic would have to appear before them, his record would be examined and, if it were found that he was guilty, he would be barred from taking further instruction from any of them. Or, if he were a more advanced pilot, he would be boycotted by the rental operators. Since that announcement was issued there has been little show-off flying around Baltimore, at least in rented airplanes.

Col. William D. Tipton, manager of Baltimore's Curtiss-Wright Airport, was instrumental in bringing this about. He has said that "we realize that the irresponsible and inexperienced aviator is the common enemy. Those of us who are earning a living from aviation and want to see private flying continue to grow safer, so that it will be accepted by the public as has been air line travel, want him curbed."

The Air Safety Board describes as quite sound Tipton's suggestion that state, county and municipal police be given "a minimum of training to the end that they would be able to enforce intelligently the simple rules of flight." Another well thought of suggestion is that of Howard Stevens, one of the youngest flying school operators in the country, and John K. Hinson, *Cub* dealer and manager of Rutherford Field, where Stevens operates. They advocate that an unsalaried deputy be provided at each field. This man—probably the airport manager—could serve as field officer and have legal right under state or local law to enforce the air regulations. With the backing of the state, for instance, he would have the power to order a passenger out of a student's plane, if he saw such a violation of regulations about to occur.

Close students of the situation believe further that every private pilot is going to have to take it upon himself to help curb the deadly show-offs. Otherwise—and Tom Hardin's and C. B. Allen's reminder that the Air Safety Board has suggested restricting solo pilots to within gliding distance of the field indicates as much—the sportsman pilot is going to find that his own privileges are becoming fewer and the restrictions upon his activities greater and greater. For their own protection some private flyers' groups would do well to start cleaning the show-offs from their midst.

As of January 1, 1940, there were 30,000 pilots in the United States. Twenty thousand of them came within the non-scheduled non-military category. They're increasing at the rate of 1,000 a month—and that doesn't include the 10,000 or so young people who are learning to fly under the auspices of the Civil Aeronautics Authority. That is a tremendous number of pilots. What the Air Safety Board realizes is that these new pilots can cause a boom in the manufacture of light airplanes possibly comparable ultimately to the rapid development of the automobile industry a few years back. This can be done only if the new pilots' conduct is guided along the right path and provided they are equipped with reasonably safe airplanes and taught that flying is a great sport but can be a dangerous one. If this isn't done, all concerned fear, a wonderful avocation of tremendous value to the economic welfare and the national defense of the country is going to die in its now-lusty infancy, simply through public revulsion.

END

Is Italy A Threat?

(*Continued from Page* 13)

These materials have been largely out of Italian reach for this reason. She has had to depend on supplies from the smaller countries willing to make barter agreements.

Spruce for the wooden planes of which Italy has built so many in the past (the Savoia-Marchetti bomber's wings are wooden) comes chiefly from Oregon, Washington and British Columbia. Italy tried a year ago to secure spruce from the Baltic countries, who were willing to barter it for Italian goods. Baltic spruce, however, is mostly second growth stuff and unsuitable for aircraft. Of the important raw materials going into warbirds only aluminum's ore, bauxite, is readily available. Hungary and Yugoslavia, with whom Italy has long had close relations, are among the biggest bauxite producers in the world. But you can't make engines out of dural. The Italian army and navy are in the same kind of trouble. Chemical science has accomplished wonders in easing shortages in Germany, Italy and elsewhere already, and has created thousands of new products. But there are some things it will take a long time to produce from the resources available to Italy. Thus it is that a power once in the forefront in military airpower has now to take a second place. Italy is not likely to move to the head of the class again for a long time to come.

END

"Flying" Taxicab

PILOTS listening to the Pittsburgh traffic control operator at the Allegheny County airport recently were startled when the operator, apparently a newcomer, said "A Yellow Cab is taking off from the north-south runway." A landing Pennsylvania-Central Airlines pilot advised the radio operator that the airplane that had taken off just ahead of the airliner was a yellow *Cub*, and that the only cabs were on the other side of the airport fence.

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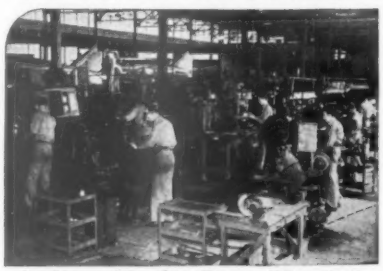

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Plane Parade

(*Continued from page 37*)

plane for military service. As a result the Government purchased the machine, making the United States the first owner of a military airplane (it was actually used by the Signal Corps for several years) and setting the precedent for the many flying war fleets of today.

The Wright brothers' earlier model, made in 1903—"first plane to raise itself in the air in full flight, sail forward without reduction of speed and finally land at a point as high as that from which it had started"—now is on exhibition in the Science Museum of South Kensington, London, one of the very few pioneer American planes not in the Smithsonian collection.

Cierva's autogiro, designed and built in England in 1928, was brought to America by Harold F. Pitcairn and flown for the first time in this country on December 19 of that year at Pitcairn Field, Willow Grove, Pa. Pitcairn used this original model for extensive experimental flying for the development of the American autogiro, and his work in this field won for him the 1930 Collier trophy "for the greatest achievement in American aviation." The Wright 1908 plane and the autogiro are placed close together in the exhibit. Thus the first successful type with rigid wings and the basic machine of the rotative wing type are effectively set off and contrasted.

Back in the less pretentious but roomier Aircraft Building is an equally thrilling galaxy of pioneering planes ranging all the way from the hull of the NC-4 (first plane to span the Atlantic) to the sleek silver *Polar Star* in which Lincoln Ellsworth explored the Antarctic plateau just a few years ago.

Among the oldest of the dozens of modern craft shown here is one of the famed De Havilland biplanes, designed in England and selected by the Army as the best model to replace the early Curtiss JN-4's (in which American flyers first were trained) and the French-made Spads in which they got their baptism of fire. The particular plane on display is the first turned out by the Dayton Wright factory, to the War Department's specifications, in 1917. It never saw actual service, being used chiefly for test purposes. Thousands like it were built by American manufacturers in 1917, but only 200 took part in the war proper. The remainder were auctioned off to private buyers after the war was over and were used on the first air mail routes.

Two Spads are on the floor—one that belonged to the U. S. Air Service chief, stormy Billy Mitchell, and one flown over the western front by Lieutenant A. R. Brooks, an American war ace. Both are duplicates of the frail craft flown by such intrepid sky-fighters as Fonck, Guynemer and Rickenbacker, and both are pock-marked from nose to tail with bullet holes. Brooks' plane is camouflaged dull brown and yellow. On its warping fuselage are still visible the falling star on a field of blue and white that was the trademark of the 22nd Aero Squadron. Also evident are the battle-scars of its seven victories. Mitchell's, likewise paint-smeared and hole-ridden, is cut away on one side so that all of its war equipment is clearly visible. Also on view is a Fokker D-7 pursuit plane that was captured at Verdun on November 9, 1918.

Most striking of the non-fighting aircraft to be found in the big, barnlike Aircraft Building is the giant wooden hull of the Navy's NC-4 which preceded *The Spirit of St. Louis* across the Atlantic by nine full years. The NC-4's history began during the world war, when many planes were needed in Europe and no ships were available to transport them overseas. The Navy, with the cooperation of the Curtiss organization, decided to develop a craft that could cross the ocean under its own power. A squadron of four NC type planes was the result. The NC-4 was the only one of these able to fly the whole distance to Plymouth, England, where she landed May 31, 1919. The elapsed flying time for her trip was just under 54 hours, with stops at Newfoundland, the Azores and Lisbon. Only the center member—the hull and fuselage—of this huge flying boat, as well as one engine, are on display. The wings and tail were too large to fit into the space available and have been stored until larger quarters can be provided.

Another record-holding craft which catches the eye of most visitors is the Fokker T-2. One of the earliest internally-braced cantilever-wing monoplanes, the T-2 was the first airplane to fly non-stop across the American continent. The flight, from New York to San Diego, was made on May 2-3, 1923, by Lieutenants Kelly and Macready of the U. S. Army Air Corps, and required nearly 27 hours.

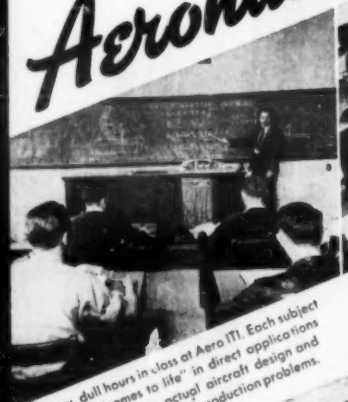
The first plane to fly around the world, the almost-forgotten *Chicago*, stands only a few feet away. The *Chicago* was the flagplane of a squadron of four Douglas airplanes, each equipped with a Liberty engine of 410 h.p., that left Seattle on April 6, 1924, flew north along the Pacific coast, skirted Alaska, made the first aerial crossing of the Pacific and then proceeded down the coast of Asia, through Siam, India and Arabia, headed up through Europe to England, crossed the Atlantic by way of the Orkney Islands, Iceland, Greenland and Labrador, and finally crossed the continent to Seattle.

Another interesting long-distance flying ship that can be seen is the *San Francisco*, airplane No. 3 of the Army Air Corps' Pan American good will flight of 1926-27. The good will flight comprised five Loening amphibians, under the command of Major H. A. Dargue. They left San Antonio on December 21, 1926, and their course extended through Central America, down the west coast of South America, across the Andes, up the eastern shore of Argentine, Uraguay, Brazil, Guiana and Venezuela, through the West Indies, and up to the Atlantic

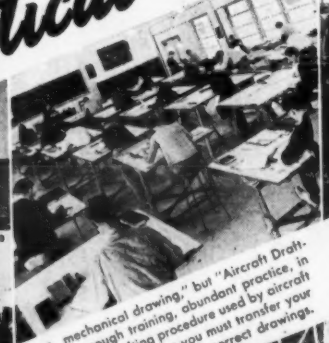
FROM YOUR MIND MAY COME DESIGNS FOR *Tomorrow's Planes*

Many creators of yet undreamed of developments in aircraft design—aeronautical engineers of tomorrow who will help shape Aviation's breath-taking future, are today but untrained engineers of tomorrow who will help shape Aviation's breath-taking future, are today but untrained young men. Some of them already believe earnestly in their natural aptitude for aeronautical engineering—others do not yet realize that they possess creative ability and suitable talents. If for young men looking forward to an aeronautical career, Aero Industries Technical Institute has created a NEW type of training. This training is sound and authoritative by the usual educational standards, but in addition, it is intensely practical. The student learns aeronautical engineering as it is actually applied in the industry . . . for Aero Industries Technical Institute is awake to Aviation's need for engineers whose creative ability has been teamed with practical knowledge and experience. How this is done at Aero ITI is indicated by the pictures below.

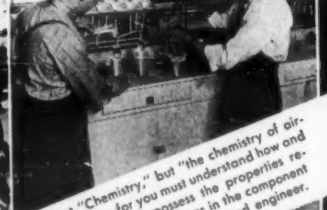
Aeronautical Engineering Training—the Practical Aero ITI Way



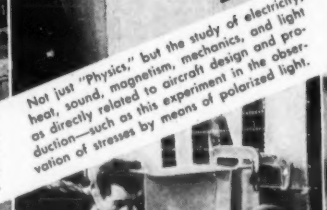
No dry, dull hours in class at Aero ITI. Each subject "comes to life" in direct applications to actual aircraft design and production problems.



Not "mechanical drawing," but "Aircraft Drafting"—thorough training, abundant practice, in the identical drafting procedure used by aircraft builders themselves—for you must transfer your ideas to paper in technically correct drawings.



Not just "Chemistry," but "the chemistry of aircraft metals"—for you must understand how and why aircraft metals possess the properties required for their particular uses in the component parts of planes you help design and engineer.



Not just "Physics," but the study of electricity, heat, sound, magnetism, mechanics, and light as directly related to aircraft design and production—such as this experiment in the observation of stresses by means of polarized light.

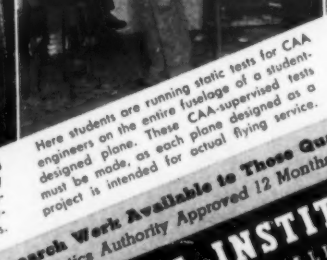
Actual aircraft design projects are carried out continuously. Here two Aero ITI student engineers are consulting on design of the fuselage of a primary trainer to be completely designed by students and built in Aero ITI'S own shops.

Here is a partial mock-up of the primary trainer, with two engineering students checking its construction against drawings. Just as in aircraft plants, at Aero ITI a mock-up of each design project is built to check construction features.

In the extensive Aero ITI shops—with a wealth of actual aircraft production equipment at your command—you gain actual experience in aircraft construction. At Aero ITI you learn how to build, to be better able to design and engineer.

To design some component part of a plane is one thing—to design it for practical, economical manufacture is another. Aero ITI engineering students must learn to do both—and that means seeing their designs through to actual assembly.

A tense moment during a static test of a wing rib attachment for the student-designed primary trainer. Just as in aircraft plants, Aero ITI students static test many individual parts following stress analyses of the aircraft components.



Here students are running static tests for CAA engineers on the entire fuselage of a student-designed plane. These CAA-supervised tests must be made, as each plane designed as a project is intended for actual flying service.

And here is how the primary trainer now serving as a student design project will look when it takes wing, a "living" symbol of practical study, practical designing, practical engineering, practical production—ALL by Aero ITI students.

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coast to Washington, D. C. Twenty-one American republics were visited on the flight; over 22,000 miles were covered.

Most modern of the famous aircraft on view in this building is the *Polar Star*, the Northrop *Gamma* in which Lincoln Ellsworth in 1935 explored the broad Antarctic plateau. In a 14-hour flight Ellsworth covered 1,500 miles, landing only 26 miles short of the camp established by Admiral Byrd at Little America. He tramped the remainder of the distance on foot. The 2,300-mile round trip jaunt proved the ability of an airplane to carry out extensive exploration with intermediate landings under extreme weather conditions; since then hardly any polar expedition has been without its aircraft.

Besides these historic planes, the building contains fascinating aerial oddities by the hundreds. Among them are the first American helicopter, a Martin K-111—one of the smallest fast planes yet designed; the gondola of the airship *Pilgrim*, the first commercial nonrigid dirigible; the gondola of *Explorer II*, the stratosphere balloon; and countless famous engines, propellers, accessories and pictures dating all the way back to aviation's legendary pre-history.

The helicopter is a queer-looking four-propellered contraption, with one screw mounted at its nose, two horizontally above its wings, and a fourth horizontally near the rudder—all geared to one small engine! Designed by Emile Berliner, an American inventor, it was successfully flown many times, rising almost vertically about 25 feet, then scooting forward at from 35 to 40 m.p.h.

The Martin first was designed in 1917 as a high-altitude fighter, but later was altered to a commercial type and became the forerunner of many later "flivver" models. Only 13 ft. 4 ins. in length and 7 ft. 4 ins. high, in its flying days it could attain a speed in excess of 100 m.p.h., and its tiny English Gnat ABC engine could hold out seven hours on the nine gallons of gas stored in the upper wing!

The *Pilgrim's* gondola, when it retired to the calm and quiet of the Aircraft Building in 1931, held the record for nonrigid airship flight, having made 4,765 hops in the course of its 5½ years of service, and carried 5,355 passengers in its crowded compartment.

The *Explorer II's* gondola is a round, bathysphere-like structure of magnesium alloy. Although it weighs under 650 pounds, it carried two men and more than a ton of instruments to a height of 13.7 miles above the earth on November 11, 1935, ascending from the "stratobowl," near Rapid City, S. D. For this flight, incidentally, it was attached to the largest balloon ever built.

Among the famous engines which one may examine at close range are the Wright *Whirlwinds* which powered the flights of Lindbergh, Chamberlain, Byrd and others; the original Liberty and Packard-Diesel engines; the Hendee rotary engine, power-plant of the first American mailplane of 1911; the Wright D-1 type, used to power large dirigibles; and four Curtiss models which clearly show the development of aviation powerplants over a period of 20 years.

The propeller collection depicts every phase in the transition from the crude square blades used by Santos Dumont in 1898 to the most modern of metal propellers and includes huge airscrews such as were used by the dirigibles *Akron* and *Shenandoah*. Accessory exhibits show flying equipment of every imaginable type, dating back to the earliest days of aviation: patent models of "dream planes" that never quite materialized, ordnance used by fighting craft; and instruments of every type, both old and new.

Not even this rather extensive description of the aircraft collection does it justice, for there are so many amazing odds and ends scattered about that even to catalogue them all would require a book of many pages. Suffice it to say, then, that anyone interested in any phase of aeronautics will find the show dramatic, entertaining and instructive; and unquestionably well worth a trip to the nation's capital.

END

Landings

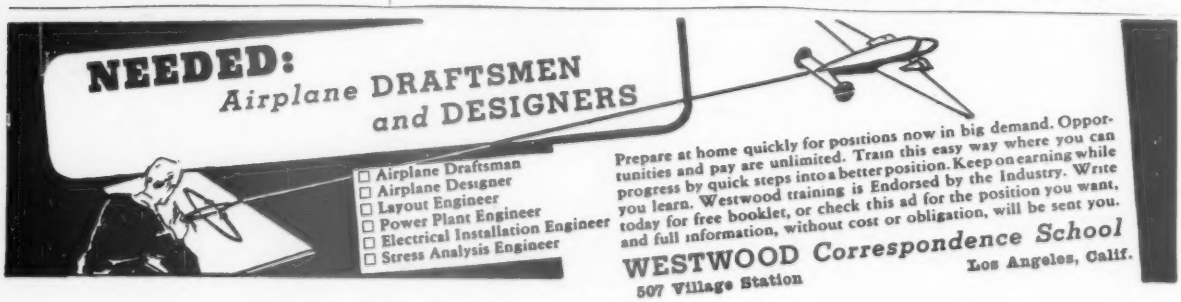
(*Continued from Page 46*)

Francaise. He has been associated with the U. S. Army Air Corps since 1917. So far as the system he developed is concerned, he feels that the results have been satisfactory. He would, however, like to develop a machine that would eliminate the course and anemometer observers. Meanwhile, it is likely that a system of recording all phases of an airplane's performance, including aerobatics, will result from the present system.

END

Pilots Wanted!

THE shortage of airline pilots has become so acute that United Air Lines' chief pilot, R. T. Freng, is touring the country in the company's Boeing 247-D flight research ship seeking applicants.

NEEDED: Airplane DRAFTSMEN and DESIGNERS

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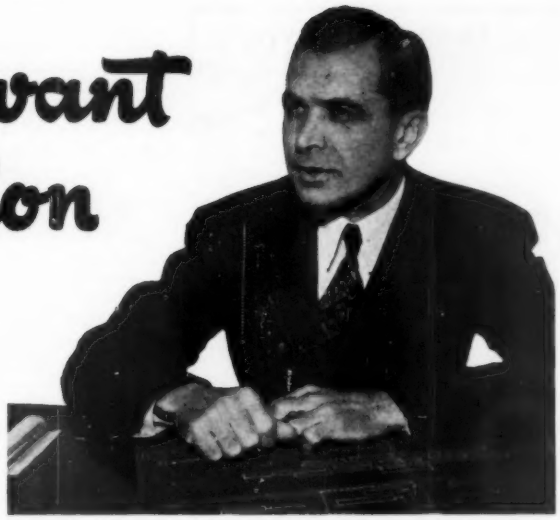

I offer you both a word of encouragement and a warning. Aviation holds many opportunities for young men with proper training. But it offers nothing to the untrained man and little to the man with inadequate training. Therefore, selection of the right school is about the most important decision you'll make in your aviation career.

Is the school government licensed? Is it industry approved? Does it teach modern methods? What connection has it with the industry? What is its record for placement of graduates? *Get the right answers to these and other questions before you lay out a dime on anybody's course.*

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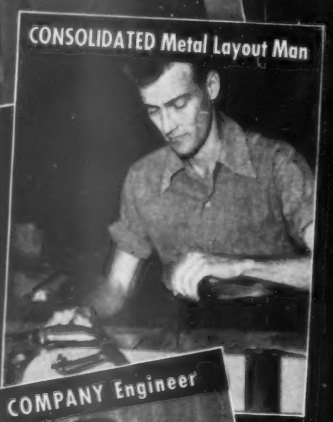

THREE MORE RYAN GRADUATES WHO ARE MAKING GOOD IN AVIATION

Pictured top to bottom: Walter McIntyre, Chicago, Ill., graduate Ryan Transport course, now TWA First Officer. John E. May, Jersey Shore, Pa., graduate Ryan Master Mechanics course, now sheet metal layout man with Consolidated Aircraft Corp. Edward Baumgarten, Pasadena, Calif., graduate Ryan Aeronautical Engineering course, now employed in Engineering Department, Ryan Aeronautical Co.

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Brass Hat

(*Continued from Page* 41)

Canada, Fonck of France, Rickenbacker of the United States, Richthofen of Germany, and others—piled up impressive records of victories in individual air combat. The armies were smaller and the lines more lightly held. The air forces were smaller also and the British machines were often obsolete compared with those used on the western front. The Germans had faster aircraft than the British but none too many of them and they were careful. They used their speed to avoid air combats and the loss of machines. Repairs and supplies were slow in arriving and the men had to develop into mechanical experts to keep their aircraft in operation.

It was an ideal training place for Croil's subsequent duties. Pilots had to learn by hard experience not merely the theory and practice of war in the air but a lot about the servicing and maintenance of their equipment.

Croil served with a fighter squadron and flew regularly over the enemy lines, escorting bombing and reconnaisance machines. When the Germans took to the air in the direction of the British lines on similar missions he played his part in driving them off. He had many combats but came through a year's service without injury and wound up his front line service as a flight commander in charge of all air operations on a sector of the front.

After his year with the forces north of Salonika he was transferred to Egypt where a large training center was established. The Egyptian climate permitted flying almost every day in the year and, as the Allies needed pilots and needed them quickly, the land of the Nile was chosen as the site. Croil spent the rest of the war in Egypt except for occasional flights into Arabia on patrol and transport work. For the greater part of this time he commanded a training wing and his work won him the Air Force Cross.

There he came in contact with one of the most powerful but mysterious personalities of the war, the famed Col. T. E. Lawrence, Lawrence of Arabia. Croil piloted Lawrence on many of his visits to the Arab chieftains whom he won over to the Allied cause. He saw the influence wielded by this highly-cultured Englishman over the men of the desert and attributes it to the fact that Lawrence never betrayed a confidence and never broke a promise but also to the pains he took to master the arts and crafts of Arabia. He could do anything the Arabs did as well or a little better than they.

War brings its narrow escapes to every pilot who comes through. Croil had his share but one stands out because it involved Lawrence and because of the difference it might have made had the two perished. It was in the autumn of 1917 before Lawrence's work of winning the Arabs over and welding them into a fighting instrument for the Allies was far advanced. The two flew into the desert in search of a missing aircraft and landed to question some Bedouins.

As they were taking off a mirage caused by heat waves above the sand obscured the view. They thought they had a level stretch of sand in front of them but before they attained flying speed found themselves headed towards a ravine. The ground literally fell away from under the aircraft and just as they were about to crash into the opposite bank Croil managed to swing to the left, fly down the length of the declivity and climb away.

Many historians regard Lawrence's work in Arabia as one of the decisive factors in the war. Had he been killed at that stage many things might have turned out differently. The old Turkish Empire might not have been toppled. The British might never have gained Palestine. The creation of the Jewish national home there and its consequent troubles might never have come about. Lawrence lived to fume in impotence at what he considered his country's failure to keep the bargain he made with the Arabs, to write his "Seven Pillars of Wisdom", to seek solitude by enlisting as an aircraftman under an assumed name and to die in a motorcycle accident. His pilot lived to attain high rank and serve in another war.

Croil's flying career almost ended with the Armistice in November, 1918. Before the war he had tried his hand at growing rubber trees in the Far East. Now he moved westward to start a fruit farm in the Okanagan Valley of British Columbia. On arriving in Canada, however, he heard of the possibility of a Canadian air force and stopped at Ottawa to file an application. In due course he was called back from his farm and so was in at the birth of the service he now heads.

Hundreds of Canadians served with the British air service in the first great war but there was no independent Canadian establishment. It started in a small way about 1921 and for years was a puny infant. Disarmament was in

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the air, politicians took little interest in defense and appropriations were meager. Gradually, however, the nucleus of a force was established and, by doing a lot of essentially civil aviation work such as surveying in the Far North, a group of zealous officers managed to justify its existence. Croil served in many capacities in the slowly growing force. He commanded stations at High River, Alta., and Camp Borden, Ont. He acted as liaison officer at the Air Ministry in London.

In the early thirties the government, hard-pressed for funds due to the world depression and still looking for a long period of peace, dealt the Canadian air arm a serious blow. Appropriations were slashed, many officers were discharged and others left. Croil stuck it out and became senior air officer just when the fortunes of the force were at their lowest ebb.

From 1935 on the Hitler menace grew and forced the Canadian government to take stock of the country's defenses. A new defense policy was evolved which made the air force a fundamental element in the defense set-up designed to meet naval attack, air attack by ship-born aircraft or air attack by planes operating from bases which might be established at isolated points on this continent.

The result was the air force ceased to be an adjunct of the army. It was elevated to a status of equality with the navy and the army and Croil became chief of an air staff instead of senior air officer under the chief of the general staff. Grants were increased, new and modern planes were ordered, training of new men was started.

So when Hitler sent his smooth-working armies into Poland, and Great Britain and France with the backing of Canada and the other overseas nations of the British Empire decided to stop German aggression, the Royal Canadian Air Force under Croil was reasonably ready to meet attacks which might be directed at Canada. Participation in hostilities in Europe was another matter, however, and by agreement Canada was assigned the role of training men for aerial warfare.

END

Tricycle Landing Gear

A RECENT market research project conducted among 1,000 pilots, operations managers, maintenance superintendents, engineers and company officials of airlines showed marked preference for the tricycle landing gear. Of those answering the Lockheed company's questionnaire, 89 per cent favored the tricycle gear, only 23 per cent ever had flown planes with this type gear and 11 per cent stated a preference for the conventional landing gear now in use. Of the 89 per cent, 60 per cent favored the nose wheel being steerable by rudder pedals. Pilots were more divided as to whether brakes should be on all three wheels. 51 per cent said yes, 49 per cent said no.

Reconnaissance

(*Continued from page* 18)

ficient in the use of the machine gun, and also an expert photographer. Aerial photography is an art in itself, for all the modern automatic cameras and gadgets. Photos furnish a permanent and accurate record of enemy goings-on and the element of human error in perception is entirely eliminated by this use of the aerial camera. There are four types of these all-important photographs which the observer must furnish:

Vertical photos are those taken through the floor of the reconnaisance plane, wherein the camera lens' axis is set perpendicular to the ground. This type is used largely for intelligence purposes and survey mapping.

Oblique photos may be taken through the plane's floor aperture or from the cockpit. In either case the axis of the camera lenses is set downward at an angle of approximately 30 deg. below the horizon. This is easier to interpret, although it lacks the detail of the vertical picture and often reveals objects that could not be discerned in a vertical print. These are of particular value for study of terrain features and for the guidance of troops who are advancing over strange ground.

Stereographs are composed of two different photos taken in rapid sequence with about a 60 per cent overlap. In Europe this operation is sometimes conducted by two planes flying abreast or in echelon, thereby providing different angles of the same objective. The two prints are viewed through a stereoscope—not unlike grandma's—and the resultant image clearly defines relief of objects.

Photographic mosaics, as implied, are sequence shots which are placed together to form a composite, which in turn is photographed and reproduced. This type is an excellent substitute for unreliable or nonexisting maps.

Tactical interpretation of these types of aerial photos and the study of them is much more difficult than is at once apparent. Generally speaking, the same clews which make identification possible from the air provide G-2 with an analysis of a photo, but there are three phases of the analyzing process.

The *interpretation* is determining the meaning of any photo and of the nature of the objects thereon. *Restitution* involves the locating of these objects in relation to the map of the vicinity, and the work of transferring "points of interest" from the photo to the map. *Exploitation* is further detective work: comparison of the new photos with older ones of the vicinity to determine enemy movements.

The actual photographic operations and the camera equipment employed would furnish material for a complete and interesting book. The United States and Germany made many contributions to the art; one of the latest and greatest is that of the infra-red ray film. The camera so equipped can photograph—through haze, fog and even light clouds—objects which cannot be seen through powerful field glasses. It is believed that the remark-

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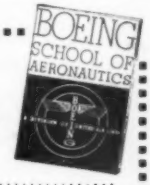

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Scouting and reconnoitering are not so spectacular as the combat branches' operation, but equally important. The planes that do the job today are as cleverly designed as a fighter or attack ship. Our North American O-47A, with which Air Corps and National Guard observation units are equipped, is just about tops. This all-metal craft has a wing span of 46 feet and an overall length of 33 ft. It carries a useful load of 1,698 pounds over an 853 mile cruising range. The O-47A's outstanding feature is a deep, low-slung belly that is provided with large windows and floor panels for the observer and photographer. The 860 h.p. Wright *Cyclone* engine and the ship's clean design afford a 243 m.p.h. top speed, but the use of wing flaps keeps the landing speed down to 67 m.p.h. The plane is fitted with two-way radio, a Fairchild camera and is armed with three Colt-Browning machine guns.

Many of our "contemporaries" boast excellent prototypes: the British Westland *Lysander* is one of the best. This gull-winged monoplane is powered by an 890 h.p. Bristol *Mercury* radial, has a top speed of 229 m.p.h., a 600-mile range and is armed with three Browning guns. Germany's Henschel Hs-126—also a high-wing two-seater—is only slightly slower with a speed of 220 m.p.h. Powered by an 870 h.p. B. M. W. radial motor, it has a range of 680 miles. France's Mureaux 200-A3 is of the same general description. It is, however, powered by an 850 h.p. chemically-cooled Hispano-Suiza engine and only achieves 200 m.p.h.

Japan and Italy employ biplanes for their reconnaissance work, the former country using a type called the "Army 94". This metal-fuselage ship is powered by a 550 h.p. Nakajima radial engine and has a top speed of only 189 m.p.h. Both Italian types were used in Spain: the Romeo "37", a two-seater employing a 700 h.p. Fiat radial engine, has a 210 m.p.h. top; and the Meridionali, powered by a 1,020 h.p. Piaggio radial, attains 223 m.p.h. Japan's "Army 94" is being used in the war in China.

Modern tactics are demanding an observation plane that can bomb the enemy as well as tell on him—thus the reconnaissance bomber. Typical of this type is the Lockheed *Hudson* of which Britain ordered several hundred. Two 800 h.p. *Hornet* radials power this 65-foot, 17,500-pound craft, giving it a speed of 245 m.p.h. and a 1,660-mile range. Germany's Henschel Hs-124 also answers to this description, but is powered by Daimler-Benz chemically-cooled engines or, in later models, with two 870 h.p. air-cooled engines.

We wonder what kind of work they'll think up for reconnaissance ships next; most of the German seaplane reconnaissance bombers were reported to be at work dropping parachute mines at the mouth of the Thames.

END

Plane and Law

(*Continued from Page 28*)

knownst to the operator, the pilot had a flask in his pocket. Once in the air, he proceeded to get roaring drunk and did all the acrobatic maneuvers known, plus a couple he invented on the spur of the moment. He ended by stacking the ship. The operator recently was awarded the full value of the ship by the court.

In another recent case, an operator rented his ship to a pilot who spun it in making a down-wind landing. The operator charged negligent operation. The lower courts decided in favor of the estate of the pilot, who was killed in the crash, but the operator took the case to a higher court and got an order for a re-trial. The case, which involves $4,000, the value of the destroyed airplane, still is pending.

The lack of precedent is so marked that, as I have said before, it is hard to find an attorney versed in aviation law who will commit himself on many questions propounded. However, there are several other hypothetical situations into which you might plunge while flying an airplane which offer a general answer.

For instance, if you got hold of faulty fuel could you recover from the company which sold it to you? The legal consensus is that you could. Not long ago a pilot who had crashed due to impure fuel sued the oil company which had supplied it. He had an excellent chance of winning and might have established a precedent to answer the question for all time had he not failed to bring action until the statute of limitations had come into effect in his case.

Supposing an aircraft manufacturing company delivered to you a faulty plane—could you sue and collect if it crashed? The chances are, my friends tell me, that you could. Precedent for this lies in a series of suits brought by owners against an automobile manufacturing company many years ago. The company built a car on which the flywheel disintegrated. Sections of the flywheel crashed through the floorboard and amputated legs or mangled them.

The matter of ownership of air is a legal problem of great interest these days. Many years ago Blackstone, the famous British legal writer and authority, set forth that the owner of property owned all the air above it. This makes you and me trespassers every time we fly over private property and, in the case of airlines, it would be necessary for them to buy land to establish right of way, which is obviously an economic impossibility.

So the spirit of the law has been changed during recent years, and the air is now divided into two zones. The lower zone, next to the ground, is legally known as "the zone of effective user." If an owner can prove he is using the air up to a certain height above the ground, that air is his. To give an example of what this means,

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consider a recent case in which a farmer, angered because an airline flew its planes over his property after they had left a field runway, erected 60-foot poles at the edge of it. The airline sued to have them removed. The court decided that the farmer's zone of effective user at the point where he erected the poles was 25 feet. He cut his poles down just under that height and left the remainder standing.

The zone of effective user varies in relation, generally, with the size of buildings erected thereon and the uses to which they are put.

Most suits against airports by neighbors are brought on the grounds that a nuisance is being maintained, however. In a case against Roosevelt Field, on Long Island—and you, with your own private field and your one plane on your own property are just as apt to be sued—on the claim that night operations were a nuisance. A compromise was effected by owners of adjacent property and the airport operators under which airplanes were permitted to use the field during the day and until 10 p. m., but operations must be curtailed after that hour. To establish a nuisance it is necessary to prove a series of acts over a reasonable period of time.

In other words, if you flew low over Farmer Brown's barn to call on a girl living on the property next door once or twice and awoke Brown, but didn't do damage of any kind, he couldn't do anything about it but get mad and make threats. If he sued, the court would decide against him because he wouldn't be able to prove any damage. But if you persisted in dropping in every night and disturbing his rest, he could go to court claiming you were invading his zone of effective user; perhaps flying so low over the hen house that his fowl stopped laying eggs. If he didn't get anywhere this way, he could claim you were maintaining a nuisance, that you kept him awake, frightened him, blew dust in his window and otherwise annoyed him.

The chances are you'd be stopped.

END

Test New Bomber

ARMY pilots now are test flying the latest four-engined bomber, the Consolidated XB-24. Pertinent data on this radically new bomber are: four Pratt & Whitney 18 cylinder, twin-row 1,200 h.p. engines which turn hydromatic three-bladed propellers each of which is 12 feet in diameter. Gross weight of the new ship is 20 tons. Span of its revolutionary new wing (first used on Consolidated's Model 31 flying boat, still undergoing tests) is 110 feet. The ship's length is 64 feet, height is 19 feet and its normal crew consists of from six to nine men, depending upon the mission. The landing gear is tricycle and retractable. Normal range with a load is 3,000 miles; top speed is well over 300 m.p.h. Permissible bomb load is 8,000 pounds.

Flight by Night

(*Continued from page* 21)

the lights to show on the ground. Suddenly, a blur of whiteness appears on the ground. As I descend the blur becomes smaller as my lights begin to focus on the ground. Now I can see the features of the ground. It seems to fairly leap at me. I pull back on the stick with a jerk. The ground does not seem to be there. From the tower, radio instructions: "Take it easy, bring her down to the ground. Now easy on the stick." I land with a thud. My wings wobble and I feel certain that I will drag a wing. Then my airplane becomes steady and rolls smoothly along the ground. I have made my first landing by wing lights.

Back in my zone, I analyze my landing. I had too much flying speed and so when I jerked the stick back I ballooned my airplane into the air. Well, the next time I will know what to expect. When I suddenly see the ground coming at me, I will be easier on the stick. I make two more landings and, on the third one, I get the signal to taxi in to the line. The landings were nothing to brag about and I realize that landing with wing lights is the most difficult phase of flying that I have yet had.

Time flies at Randolph Field. My third and last night of basic training in night landings finds me again in Lower Zone 1. I circle as I wait my turn to drop a parachute flare and make a landing by it. The zones are again "stacked," so Upper Zone 1 will drop his flare first. Upper 1 gets his signal and I see him fly into position. A few seconds later the whole heaven is lighted by the powerful flare he released. Above the light I see the tiny silk parachute floating and swaying. The flare appears to be falling right in the center of the field. In reality, it will float at least one mile beyond the field and, by the time it lands on the ground, it will have completely burned out. I see Upper Zone 1 circle and make his landing. A few seconds later the flare has completely burned out and the night seems even blacker. His flare burned approximately three minutes, so I know I will not have time to waste after I release my flare.

In my off-duty hours I have watched other students make landings by flare-light, so I know I will have more than enough light to make my landing by. My only worry is the shadow that is cast by the oscillating parachute. Just suppose the shadow covers the ground about the time that I am ready to set my airplane down? My instructor has told me that if this should happen just sit tight, give the airplane a burst of the gun to keep it in the air a second longer and thus permit the flare to oscillate back, leaving the ground in the light.

My zone signal is on. I begin to climb to get in position for dropping my flare. The wind is from the west. I must drop my flare on the west side of the field so the wind will drift it across the landing area. However, the

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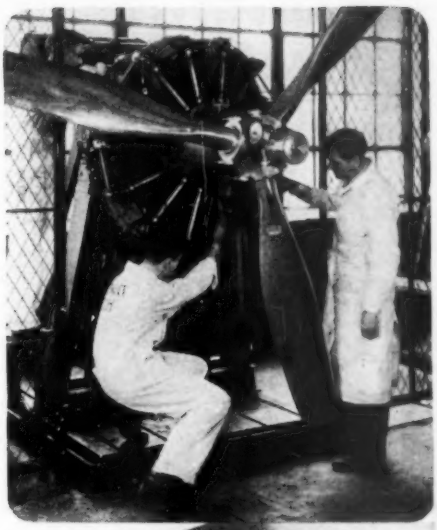

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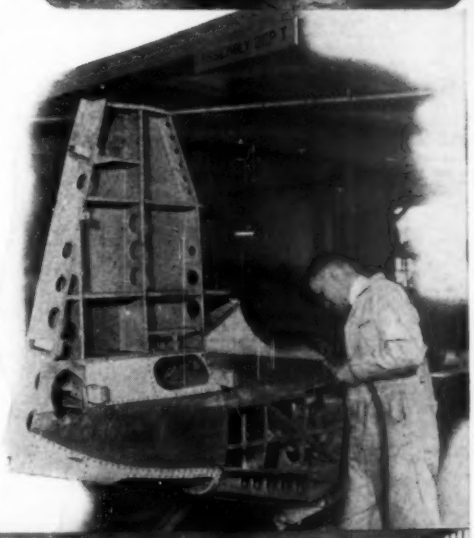

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tower is taking no chance that I will drop it in the wrong place for at this moment I get radio instructions: "Climb to 2,000 feet, fly down the line of west boundary lights and drop your flare when you get the radio signal from the tower." Thirty seconds later, as I fly down the line of boundary lights, I get the signal to drop my flare.

The whole sky lights up. I can see the ground almost as well as in daytime. This is going to be even easier than I had anticipated. I know the flare will burn for about three minutes and so I lose no time in getting into landing position. I cut my gun and make a 360° approach into the field. My flare was dropped in an excellent position. I have no difficulty keeping within the light. Things are going too well. I level off. The shadow comes over the field. I give my airplane the gun as I have been instructed. The shadow passes and I make my landing with ease.

Back in barracks, tired but happy, I do a little barracks flying. Two hundred other cadets feel just as I do. We are through night flying at Randolph Field, but there isn't one of us who is not looking forward to Kelly Field and the more advanced night flying: follow the beacons, see the lights of the countryside, and best of all, hear the purr of the engine as it drinks in the cool, moist air of the night. I shall always remember the familiar call: "Zone 1 come in for a landing." And the answer: "Zone 1 coming in."

The night is sweet and the air is soft and, with deep satisfaction, I realize what a great racket this night flying really is when you get the hang of it.

END

Pioneer Flivver

(*Continued from Page* 24)

bered. Altitude of 50 or 60 feet was attained, Timmons recalled. And, adding to the miracle, was the fact he brought the ship down undamaged.

Less fortunate was Fry in his efforts to get the homemade plane off the ground. Try as he would, it wouldn't behave for him. The only time the ship acted like it might take off for him, it suddenly slammed into a cornshock and plopped solidly to the ground.

Timmons, however, made 30 or 40 short flights with the plane, none of which was notable for altitude—speed or distance. Recalled the Beloit detective:

"I never crashed but once I hit a woodchuck hole on the ground and rolled over. The plane came to a stop on its nose."

Irony of the yarn is the fact that after his experience with Beloit's first homemade plane, the only man to get it off the ground gave up flying. Fry, unsuccessful in flying the plane, later became an aviator and was an instructor at Rantoul, Ill., during the days of the first world war. He quit flying after the war and now operates a northern Minnesota resort.

END

AOPA News

(*Continued from Page* 52)

has asked to be represented before the aviation body of the U. S. Chamber *before* such a thing is circulated in published form, for we imagine that this current report will be the cause of considerable embarrassment to the Chamber, once news has leaked "back home" to the real *flying public* who use the other eighty-three per cent of America's airports! Fourteen of the committee's 15 members have no connection with aviation whatsoever; the 15th is an airline president. . . .

N. I. F. C. Meet

We understand the National Intercollegiate Flying Meet this year will be held June 20, 21 and 22 at Lock Haven, Pa. Through an arrangement with the Piper Aircraft Company, college participants are to have the use of a number of *Cubs* at the rate of $1.00 per hour. William D. Strohmeier is in charge of local arrangements. Both Bill and J. B. Hartranft, Jr., AOPA's executive secretary, were past presidents and founder-organizers of the NIFC some six or seven years ago. AOPA will assist in every way possible to make this annual meet a continued success.

Table of Organization

From time to time numerous questions have come into us regarding the way in which the AOPA has been organized. To answer these graphically, we are showing herewith a table of organization for the AOPA. The functions performed at AOPA's two principal offices and the inter-relation of membership servicing and flight promotional activities are easily understood by means of this chart. Briefly, the Chicago office has been commissioned with "heavy work" of getting out large mailings, and servicing all membership requirements that calls upon a sizeable clerical staff. Chicago also is the center for membership solicitation, one of its chief functions.

The New York office concerns itself with the national program of AOPA, its policies and the obtaining of new services and aids for membership. Also, cases requiring individual assistance to members are usually handled from New York. Mail on any subject will be promptly routed into the proper channel if sent to either office.

CAA Reorganization

By the time this appears in print the C.A.A. squabble will probably have been a matter of history. AOPA has been vigorously fighting the proposed change of status of the C.A.A. to the Department of Commerce. As a part of our campaign we circulated a letter to all Senators and Congressmen. The following Congressmen were among those who answered AOPA's protest and worked for the defeat of the C. A. A. measure in the House of Representatives: John W. Swynne (Iowa), Albert E. Carter (California), John C. Schafer (Wisc.), Arthur B. Jenks (N. H.), Fred J. Douglas (N. Y.), William Lemke (N. D.), Louis Ludlow (Ind.), Leonard W. Hall (N. Y.), C. Jasper Bell (Mo.), Fred Bradley (Mich.), Oscar Youngdahl (Minn.), Robert F.

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Kodachrome And How To Use It contains, too, a gallery of 101 striking Kodachrome photographs reproduced in full color—the best work of not only Dmitri himself, but of other experts: Anton Bruehl, Toni Frissell, Edward Steichen, Carola Rust, and some talented amateurs. With each plate is all the data incident to taking the shot, and each illustrates the application of Dmitri's easily mastered principles, which make it possible for any good amateur to take magnificent colored pictures.

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LOOK OUT BELOW!

It's open season over there! Bombers are going to town literally and colloquially over war-torn Europe! In an authoritative article, James L. H. Peck, author of "Armies With Wings," brings you an up-to-the-minute account of modern bombing operations; methods of bombing; types of "eggs" used; charting the attack; sights; and types of bombers. Read this great article and you'll know why the modern bombing plane and the eggs she hatches upon military and helpless alike make her more to be feared than any of man's weapons!

FLYING ON THE GROUND

One of the most practical methods of teaching aviation today is by using the Link Trainer. Here is a device whereby instrument flying conditions are faithfully reproduced without ever having to leave the ground. It is possible to do almost anything in the Link Trainer that one would be able to do in an airplane—banking, gliding, turning, climbing, beam flying, instrument flying and landing. Don't fail to read this informative article by Lt. Robert J. Bruton of Kelly Field, Texas.

LIGHT PLANE ROBOT

THE SCENE: A light plane factory. THE TIME: Two years, or perhaps just one year hence. As tiny planes come sliding off the assembly line into the instrument department the foreman looks at a check sheet and bawls to the installation crew: "Numbers 3, 5, 6, 7 and 9 get automatic pilots!" Fantastic, you say? Not at all! Read "Light Plane Robot" in next month's P. A. Dick Martin of Amarillo, Texas, takes you on a test flight in a robot-equipped plane and shows you exactly how this unique instrument operates.

Watch for These Features in the AUGUST ISSUE

POPULAR AVIATION

On Sale At All Newsstands July 10th!

Rich (Pa.), Caroline O'Day (N. Y.), Harry R. Sheppard (Calif.), Joseph W. Martin, Jr. (Mass.), Lewis K. Rockefeller (N. Y.), Robert G. Allen (Pa.), Clarence J. McLeod (Mich.), and Dewey Short (Mo.).

Those who have worked with AOPA in the Senate are H. C. Lodge, Jr. (Mass.), Warren R. Austin (Vt.), Arthur H. Vandenberg (Mich.), D. Worth Clark (Mo.), Styles Bridges (N. H.), Robert Taft (Ohio), Chan Gurney (S. D.), Arthur Capper (Kan.), James J. Davis (Pa.).

END

I Learned About . . .

(*Continued from Page* 51)

water. I assumed correctly that it was the ocean.

What to do? I did the only thing I could do, now that I was in a perfect spot for a watery grave I guessed. I headed the ship in the direction I thought was east. East meant land. I had no sun to guide me, I had no sight of land, due to poor visibility. Out of the 180 degrees on the compass which I didn't have, I'd picked the correct quadrant. In other words, I'd taken a three to one gamble and made it. The first thing I sighted was Catalina Island, with Avalon almost due south from Port Los Angeles. The rest was easy. Soon we were easing into the field—many minutes overdue.

Since that time I have made no short flight of any kind without a thorough check of instruments, particularly the compass. Now and then I get in a hurry, but I never move so fast but what I know the compass is right. All I need to slow me down is to remember the hopeless, miserable and frightened feeling I had when I came down over the Pacific, the world's largest body of water, in a landplane with a limited supply of gasoline. Whether or not I know the terrain, whether or not the ceiling is absolute and visibility unlimited, I'm just as cautious.

In thousands of hours of flying, especially in other people's ships, I've reached a point where I now say, not "Can I get through?" but "Will I be able to bring my equipment through safely?" I'm sure that innumerable accidents, should the truth be known, have resulted from too little attention to even the primary flight instruments and that both lives and equipment have been lost through inexcusable carelessness.

My personal slogan is: "Never take anything for granted."

END

Passenger Parachutes

AN Italian air force officer, Lieut.-Col. Prospero Freri, has devised a method of dropping passengers from an airliner via parachute. Safety hooks, worked by an electric mechanism, hold the passengers' seats. The pilot need only pull a lever in the cockpit to drop the passengers out into space. Reports say this device is soon to be adopted by Italian airlines.

Winston Letter

(*Continued from page 29*)

tance. The fighters still use a three-plane section, in spite of the reports in Finland of the success of the two-plane unit.

Here are a few things I found in Finland and Sweden:

Armor: The Russian fighters, excellent copies of our Boeing P-12 and P-26, had *fully retractable* skis and heavy armor behind the pilot. Ordinary .30 caliber bullets would not even dent this armor. Russian bombers had the same for the pilot, but *none* for the rear gunner—a bad mistake, for they lost most of their bombers that way. Modern warfare needs armor for *all* aircraft personnel, especially the rear gunners.

Fixed guns vs. free guns: In Russia, the rear gunner never had a chance. It may be different elsewhere, but four guns against one is too much fire-power. The only approach the Finns used in their old Fokkers on fixed skis was the direct rear —and they shot down over 700 Russian planes. With modern planes and overhead approaches this could have been quadrupled. One Finn whom I checked out in a Brewster had shot down six Russian bombers in five minutes with his Fokker.

Bombs: The Russians put over 9,000 bombs into Tampere, Finland's second largest city, never hit the aircraft factory they were trying for and killed only 20 people. Incendiary bombs did the most damage, mainly thermite. When the Russians were short of bombs, they dropped large stones—believe it or not!

Parachutes: It's suicide today for a pilot to pull the ripcord at any altitude —the days of chivalry are past—and you're dead meat for any fighter. The Finns lost several pilots this way.

Bullets: The old .30 caliber is useless today, except for tracers to line up your heavy guns. Armor will stop anything but the heavy stuff. Explosive, armor-piercing, or incendiary bullets are the thing today. This makes some sort of protection around the fuel tanks imperative. The Russians had a heavy layer of rubber around their fuel tanks to stop leaks from bullet holes. The Finns lost a number of Gloster *Gladiators* from incendiary bullets (the Gloster has *no* firewall!) and I talked to two Finnish pilots who had bailed out after their planes were afire. Both were badly burned in their faces.

Gun sights: Everyone over here uses the electric gun sight, which is superior to the telescope or the mechanical sight in many ways. The Swedes also use it at night for dive bombing, where its advantages are obvious. Swedish squadrons in north Finland had excellent results with the Hawker *Hart* (a British type obsolete for several years.—Ed.), dive-bombing the Russian airdromes on moonlight nights.

Personnel: Comparatively inexperienced pilots often make excellent wartime pilots. I checked out 28 Finns in the Brewster, which is a rather advanced machine. Half of these pilots had only 100 hours total flying time, with less than 10 hours of fighter experience. The others had less than 400 hours, yet nine of them had shot down Russian planes. One of these shot down six Russian bombers in five minutes, in an old Fokker with fixed skis. Yet we had not one injury in two months of flying from snow-covered fields and only a couple of minor crackups. The Swedes did the same. They all prefer good airwork to good landings from their pilot material. Many pilots who made sloppy landings were good aerial fixed gunners and if a man couldn't learn to shoot they grounded him.

Well, I've tested 44 Brewsters for the Finns—dives, spins and all, and have done a little instruction for both the Finns and the Swedish Royal Air Force—flew their Seversky for them to prove that the ship was okay after one of their pilots had spun in from a triple snap roll at 400 feet. It's been an interesting trip and looks as if there will be more in Belgium (Note that this letter was mailed May 3, almost seven days before the invasion of Belgium. —Ed.). More later—boat sailing—

Best regards,
R. A. WINSTON.

END

Silence Zone

SEVERAL recent British aircraft accidents have been attributed to a mysterious "silence zone" in Kirkcudbrightshire, England, where it has been found impossible to receive normal aircraft radio navigational signals. British aircraft radio experts have been called in to solve the mystery.

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by J. JULIUS FANTA

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Here's a fascinating story about Curly Twiford, noted Hollywood animal trainer, and his money-making pets. From a stray dog and a pair of love birds, Twiford has built up a business that provides any kind of an animal for the most exotic of Hollywood scripts. Don't fail to read about "Josephine," his famous rat, and the scores of other Twiford "stars" who earn as much as $50 a day!

by FRANK CUNNINGHAM

MY FAVORITE DOG

Meet Sunnybank Gray Dawn, Albert Payson Terhune's favorite dog! This silver-and-white "merle" collie, who was the world's most bumptious and clownish pup, developed into a magnificent giant of a dog. Read how Gray Dawn, by the time he was a year old, dropped his hundred mischievous antics and ceased to be a crazy puppy; how he sought pathetically hard to become a decent canine citizen; how, to his life's end, he could not get over the unconscious trait of doing the wrong thing at the wrong time . . . a part of Gray Dawn's nature, a part of his lovableness and queer charm.

by ALBERT PAYSON TERHUNE

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July Issue On Sale At All Newsstands!

PETS

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Propellers

(*Continued from page* 53)

rangement of two propellers rotating in opposite directions is suggested. The diagram in Section 5 shows higher efficiency for a tandem arrangement than for a four bladed prop having the same solidity. The equal division of the power is of primary advantage. That may be accomplished by setting the rear propeller blades at a slightly lower incidence.

Again, tandem propellers will not twist the slipstream, which condition will increase the efficiency of the tail surfaces. Tests show that under practically all conditions tandem propellers are slightly more efficient than four bladed propellers. At top speed the efficiency is from ½ to 2 per cent greater and, at climbing speed, from 2 to 3 per cent. For the same blade layout the tandem propellers absorb a few per cent more power than the four-bladed propeller. At low blade settings or at about .65 pitch-diameter ratio, the advantages are negligible.

The spacing of tandem propellers should not be less than 15 per cent of the diameter. Closer spacing will lower the efficiency as indicated in a diagram in Section 6. In Section 7 the schematic cross-section of a dynamometer for testing tandem propellers is outlined. One propeller shaft is directly connected to the armature of an electric motor and to a bevel gear. The bevel gear drives two pinions and a bevel gear in reverse direction. The pinions are attached to a torque arm on which the distribution of power on both propellers is ascertained. The field of the electric motor is fastened to the streamlined housing to which another torque arm is secured to measure the total power input if the revolutions per unit time is known. The shaft unit may move freely axially in order to measure the thrust. It is obvious that the gear arrangement for tandem propellers has a certain weight that may be prohibitive for lightplanes even if the price may not be considered. -

The blade setting for adjustable propellers is given for a certain distance from the hub. For large propellers usually for the 42 inch distance, measured from the flat working side to the table if the propeller is placed on a vertical post. For solid propellers the slope of the blade is given by the pitch, which is generally the same over a greater portion of the blade. A sketch in Section 8 shows how the pitch is enumerated if the angle and the distance are given.

The airfoil section used for high speed propellers is the Clark Y and for low speeds the modified R. A. F. 6, both plotted in Section 9. The airfoil section should be extended as close to the hub as possible. Spinners and streamlined fuselages may increase the propulsive efficiency up to six per cent.

The minimum drag—usually the profile drag—is a function of the blade width and the speed (Reynolds Number). The drag decreases to a certain

point then increases again as the speed increases. From this it may be deducted that for low speeds the number of blades should be kept low (one blade?) and past a certain speed the number of blades increased to obtain highest efficiency, if the same solidity is employed.

The speed-width function again would put more of the blade area into the inner half of the propeller if designed for high speeds, or more toward the outer half if used for low speeds.

END

Airy Chat

(Continued from page 4)

to the British a few months ago? . . . well, *it* was the British plane that landed in Iceland by mistake not long ago . . . Those Fairchild PT-19 Army trainers will cost Uncle Sam between $7,060 and $8,370 each . . . The Guiberson diesel engine for aircraft, installed in a Stinson, brought that plane from New York to Chicago for $5.67 (cost of fuel oil) . . . Guiberson's working on a 550 h.p. model for the Navy, also a 1,000 h.p. version . . . United Air Lines has its weather eye on landplane service between San Francisco and Hawaii . . . Dick Granere, the stunt flyer, is pretty sick in Tampa, Fla. . . . Northrop (the new company) is building a ⅓-size military test plane so secret the Office of the Chief of the Air Corps doesn't know about it . . . Earl Ortman's through with Canadian Colonial Airways . . . Army pilots have been flying Boeing B-17B's between 40,000 and 42,000 feet regularly . . . toughest problem up there is extreme cold . . . Incidentally, latest B-17's will have supercharged cabins . . . Waco is said to be working on a new monoplane . . . Lindbergh showed up at Wright Field again the other day—but not before an order came through from Washington banning all visitors from the field while he was there . . . There's more basis than you think to that report that British flyers may fly American-built bombers from Newfoundland to England . . . How many people heard Mrs. Roscoe Turner on a recent radio quiz program from Hollywood? . . . Two Dutch Douglas DC-3's, being flown from the Douglas factory for delivery, were halted at Cleveland by the invasion of Holland . . . United Air Lines bought them for a song . . . Wright Field, looking for new experimental rotary-winged aircraft, has gotten offers from Pitcairn, Kellett and Vought-Sikorsky, among others . . . Don't be surprised if the Army Air Corps starts eliminating the familiar machine gun blisters on bombers; the blisters can't accommodate batteries of armament . . . Why didn't someone before now think of that swell Swedish trick of covering their air bases with autos, moving them only for their own planes? . . . Curtiss is experimenting with some twin-engined warplanes, among them an extended-shaft pusher . . . Martin has had to add armor plate to the French bombers he's building; the French did the same to their *Hawks* . . . Discovered the other day that there's a Rankin, Tex.—not the home town of Tex Rankin . . . Regarding automatic recording cameras, the Army's been using them on B-17's.

* * *

FOR all the kind comments on the POPULAR AVIATION DATA BOOK, many thanks. What bothers us most, now that the feature has been launched, is the fact that we can't allot as much space every month as we'd like to. We hope to be able to run eight new data sheets in each issue, like we have in this one. But indications are that we'll gradually have to taper off to four sheets monthly. Meanwhile, cooperation from the manufacturers has picked up admirably after the appearance of the June issue. We couldn't blame them for being quite fed up with the usual bunch of "special directory issues."

* * *

THE *Saturday Evening Post* has nothing on us. We innocently planned the Belgian Brewster fighter for our front cover several weeks ago. Suddenly—three days after deadline, of course—Bob Winston's letter (page 29) arrived out of a clear sky. There was a mad rush to get it in—without Bob's permission: we couldn't communicate with him and it was too good to leave out. Then Belgium went to war. So we feel justified in thinking we've out-*Posted* the *Post* for once.

* * *

Wouldn't you? M. K.

END

ANNOUNCEMENT

Starting with the August issue, POPULAR AVIATION will add the name FLYING to its masthead. The full name will appear as FLYING and POPULAR AVIATION. In subsequent issues the name POPULAR AVIATION gradually will be dropped, leaving FLYING as the sole name of this publication.

We make this announcement secure in the belief that this change meets with the hearty approval of those many thousands of old and faithful readers whose imprint has been made so indelibly on this industry, feeling that they will regard the new name as being more fully representative of the present relationship between this magazine and the rapidly maturing business of private flying, air travel and manufacture.

The Publishers.

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AERONCA							
Aero-Ways, Inc., Cleveland		Cont. 50	127 hr.	Feb. '41		Red	$1050
Aero-Ways, Inc., Cleveland		Cont. 50	203 hr.	Feb. '41		Yellow	1050
J. A. Atherton Co., 2478 University Ave., St. Paul, Minn.		Cont. 50	375 hr.	yes	365 hrs.	Red	1600
J. A. Atherton Co., 2478 University Ave., St. Paul, Minn.		Lyc. 50	350 hr.	yes		Green	1075
Aviation Service, Inc., P.O. Box 308, Newport News, Va.	C-3	E113C	500 hr.	July '40	Eng. 80hr.		525
Baker-Eberle Aviation Corp., Detroit, Mich.	Chief	Cont. 50	400 hr.	Oct. '38		Yellow & Gr.	1150
Baker-Eberle Aviation Corp., Detroit, Mich.	Chief	Cont. 65	725 hr.	May '39		Yellow & Blk.	1275
Baker-Eberle Aviation Corp., Detroit, Mich.	Chief	Frank. 50	915 hr.	Jan. '39	Feb. '40	Blk. & Ver.	1100
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Lyc.	250 hr.	Nov. '40		Blk. & Red	1150
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Lyc.	250 hr.	Nov. '40		Blk. & Red	1150
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Lyc.	250 hr.	Nov. '40		Blk. & Red	1150
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Cont.	200 hr.	Aug. '40	top	Red & Blk.	1395
Cincinnati Aircraft Service, Cincinnati, Ohio		Lyc.	160 hr.	Feb. '41		Red	1500
Cincinnati Aircraft Service, Cincinnati, Ohio		Lyc.	455 hr.	Sept. '40		Red	1350
Cincinnati Aircraft Service, Cincinnati, Ohio		Frank.	563 hr.	May '41		Red	1025
Edward's Flying Service, Flushing, N. Y.	Chief	Cont. 50		1 yr.		Red	995
Edward's Flying Service, Flushing, N. Y.	Sea Plane	Aeronca	200 hr.	1 yr.		Yellow	1400
Edward's Flying Service, Flushing, N. Y.	50-C	Cont. 50		1 yr.		Yellow	1295
Frontier Flyg. Serv., International Falls, Minn.	Low Wing	LeBlond 90	258 hr.	June '41	17 hr.	Gr. & Yellow	1275
G & R Air Services, 600 No. Columbus St., Alexandria, Va.		Cont. 65	275 hr.	July '40		Yellow	1445
Hobley-Maynard Air Serv., New Orleans, La.		E113C		Dec. '40	recently	Yellow & Red	550
Hylan Flyg. Serv., Rochester Arpt., Rochester, N. Y.		Aeronca	300 hr.	July '40	300 hr.		650
Inter City Airlines, E. Boston, Mass.			750 hr.	April '41	230 hr.	Gr. & Yellow	800
Inter City Airlines, E. Boston, Mass.			225 hr.	Oct. '40	160 hr.	Cr. & Bl.	1900
Al Leeward Aircraft Sales, New Kensington, Pa.	C-3	E113C		Sept. '40	100 hr.		565
H. G. Mayes, Huntington Arpt., Huntington, W. Va.	K	E113C	462 hr.	July '40	April '40	Yellow	750
H. G. Mayes, Huntington Arpt., Huntington, W. Va.	50-C	Cont. 50	690 hr.	Dec. '40		Red	995
Morey Airplane Co., Madison, Wis.		Aeronca	250 hr. motor	yes	needs none	Yellow	550
Mountain States Aviation, 3600 Dahlia St., Omaha		Lyc.	654 hr.	May '40	Jan. '40	Bl. & Red trim	1250
Mississippi Airways, Inc., Jackson, Miss.		Aeronce	406 hr.	Nov. '40	Nov. '39	Y. & Gr.	675
Portland Flyg. Service, Portland, Me.	Seaplane	65 H.P.	250 hr.	new Nov. '39		Red	2300
Portland Flyg. Service, Portland, Me.	50		200 hr. motor			Blue & Red	995
Red Bank Arpt., Inc., Red Bank, N. J.		Lyc. 50	195 hr.	May '41		Yellow	1200
Red Bank Arpt., Inc., Red Bank, N. J.	Low Wing	LeBlond 70	690 hr.	Apr. '41	10 hr.	Yellow	1000
A. R. Smith, 113 E. Commerce St., Aberdeen, Miss.		E113C	875 hr.	May '40	Nov. '39	Yellow	725
A. R. Smith, 113 E. Commerce St., Aberdeen, Miss.		E113C	800 hr.	Sept. '39	Apr. '40	Yellow	775
Southeast Kansas Aircraft Serv., Chanute, Kans.		Frank. 50		May '41	25 hr.	Orange & Tan	1100
Tred Avon Flyg. Service, Easton, Md	Chief	Cont. 65	710 hr.	Mar. '41	221 hr.	Blk. & Red	1400
Warsaw Air Serv., 422 S. Union St., Warsaw, Ind.		Cont. 50	275 hr.	Jan. '41		Blk.	1175
ARGO							
Red Bank Arpt., Inc., Red Bank, N. J.		115 Hess	420 hr.	Dec. '40	10 hr.	Red	1000
ARISTOCRAT							
Red Bank Arpt., Inc., Red Bank, N. J.		Warner 125	350 hr.	Nov. '40	35 hr.	Blue	750
BEECH							
Arents Air Serv., Armonk, N. Y.	F 17D	Jacobs 330	400 hr.	July '40	165 hr.	Gray	7750
Utah Pacific Airways, Inc., Ogden, Utah	B 17L	Jacobs	816 hr.	April '41	235 hr.		2500
E.W. Wiggins Airways, Inc., Boston, Met. Airport, Norwood, Mass.		Jacobs 285	580 hr.	Mar. '41	200 hr.		5500
BIRD							
Hood Aircraft Sales, LaFleur Arpt., Northampton, Mass.		Kinner		April '41	just topped	Red & Silver	845
Leech Aircraft, Inc., Roosevelt Fld., New York		Kinner			45 hr.		900
BUHL							
Barr Aviation Corp., Detroit, Mich.		Wright 330	225 hr.	Dec. '40	5 hr.		1000
CESSNA							
Jones Flyg. Serv., Sullivant Ave. Airport, Columbus, Ohio		Warner 125	1300 hr.	Sept. '40	July '39	Cr.	925
COMMANDAIRE							
John K. Hinson, Rutherford Field, Baltimore, Md.		Warner	1000 hr.	June '41	none		595
Rocky Mount Flyg. Serv., Rocky Mount, N. C.		Challenger	700 hr.	June '40	300 hr.		700
PIPER CUB							
Aaron Flying Service, Louisville, Ky.	J-3	Frank. 50	460 hr.	April '40	Jan. '40	Yellow	895
Aaron Flying Service, Louisville, Ky.	J-3	Frank. 50	85 hr.	Oct. '39		Yellow	1125
Airways, Inc., Waterville, Me.	J-3	Frank. 50	240 hr.	April '41			950
Aviation Service, Inc., P.O. Box 308, Newport News, Va.	J-4	Cont.	70 hr.	Mar. '41	none		1875
Aviation Service, Inc., P.O. Box 308, Newport News, Va.	J-3	Lyc. 50	460 hr.	July '40	none		925
Barr Aviation Corp., Detroit, Mich.	Coupe	Cont. 65	230 hr.	Dec. '40	none		1200
Barr Aviation Corp., Detroit, Mich.	J-3	Cont. 50	854 hr.	April '41	35 hr. eng.		1175
Bethany Air Serv., Inc., Amity Rd., Bethany, Conn.	Coupe	Cont.	78 hr.	Sept. '40			1650
Bethany Air Serv., Inc., Amity Rd., Bethany, Conn.	Coupe	Cont.	201 hr.	July '40			1500
Bethany Air Serv., Inc., Amity Rd., Bethany, Conn.	Trainer	Lyc.	510 hr.	June '40	110 hr.		900
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia	Trainer	Cont. 40	200 hr.	just relic.	topped	Silver	625
Carolina Aircraft Sales, Charlotte, N. C.	Coupe	Cont. 65	310 hr.	March '41	40 hr.		1298
Carolina Aircraft Sales, Charlotte, N. C.	J-2	Cont. 40	491 hr.	Aug. '40	60 hr.		650
Clinton Co. Arpt., DeWitt, Iowa		Frank.	525 hr.	April '41			900
Clinton Co. Arpt., DeWitt, Iowa	Trainer	Cont. A-40	550 hr.	April '41			750
Clovis Flyg. Service, Clovis, N. M.	'39 Coupe	Cont. 65	100 hr.	April '41	none	Cr. & Red	1575
Edwards' Flying Service, Flushing, N. Y.	J-2	Cont. A-40		1 yr.		Yellow	650
Ellis Eno Flying Service, Ft. Dodge, Iowa		Lyc. 50		May '41		Yellow	1100
Fox Valley Flyg. Serv., Aurora, Ill.		Cont.	850 hr.	May '40	150 hr.	Bl.	600
Gillis Flyg. Serv., 125-1st Ave. No., Great Falls, Mont.	Sport	Cont. 50	75 hr.	Aug. '40	none		1300
Gillis Flyg. Serv., 125-1st Ave. No., Great Falls, Mont.	Sport	Frank. 50	180 hr.	May '41	none		1200
Harrisburg Air Serv., Penn-Harris Arpt., Harrisburg, Pa.	J-2	Cont.	200 hr.	May '41	8 hr.		650
Geo. C. Haven, Schenectady Ct. Arpt., Schenectady, N. Y.	J-3	Frank. 50	25 hr.	Sept. '40	none		1150

DEALERS	MODEL	ENGINE	TIME	LICENSED	OVERH'L'D	COLOR	PRICE
Hawthorne Flyg. Serv., Mun. Arpt., Charleston, S. C.		Cont. A-40	600 hr.	yes		Silver	$ 500
Hawthorne Flyg. Serv., Mun. Arpt., Charleston, S. C.		Cont. A-40	May '41				675
Hawthorne Flyg. Serv., Mun. Arpt., Charleston, S. C.		Frank. 50		yes		Yellow	900
Hawthorne Flyg. Serv., Mun. Arpt., Charleston, S. C.		Cont. A-40	600 hr.	just relie.	just ovr.		675
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M.		Frank.	350 hr.	Aug. '40	50 hr.		1075
John K. Hinson, Rutherford Field, Baltimore, Md.	J-3	Frank. 50	344 hr.	Nov. '40	69 hr.		1000
John K. Hinson, Rutherford Field, Baltimore, Md.	J-3	Frank. 50	150 hr.	Sept. '40	50 hr.		1025
Hood Aircraft Sales, LaFleur Arpt., Northampton, Mass.		Cont. 50	375 hr.	Sept. '40		Yellow	895
Hudson Valley Air. Co. 68 Dolson Ave., Middletown, N. Y.		Cont. 50	230 hr.	Dec. '40	none		1050
Hudson Valley Air. Co., 68 Dolson Ave., Middletown, N. Y.		Cont. 40	300 hr.	March '41	20 hr.		700
Hudson Valley Air. Co., 68 Dolson Ave., Middletown, N. Y.		Cont. 65	28 hr.	Oct. '40	none		750
Hylan Flyg. Serv., Rochester Arpt., Rochester, N. Y.	Coupe	Cont. 65	450 hr.	May '41	25 hr.		1450
Inter City Airlines, E. Boston, Mass.	Coupe		225 hr.	Mar. '41	none	Blue & Red	1650
Lexington Flyg. Serv., Inc., Municipal Airport, Lexington, Ky.		Lyc.	560 hr.	yes	none	Yellow	975
Lexington Flyg. Serv., Inc., Municipal Airport, Lexington, Ky.		Frank.	180 hr.	yes	none	Yellow	995
Lynchburg Air Transport and Sales, Lynchburg, Va.	Coupe	Cont.	150 hr.	Sept. '40	50 hr.		1700
H. G. Mayes, Huntington Arpt., Huntington, W. Va.	J-3	Cont. 50	530 hr.	Feb. '41		Yellow	995
McBoyle Cub Sales, Spring Green, Wis.	J-3 Sport	Frank.	77 hr.	Sept. '40			1200
McBoyle Cub Sales, Spring Green, Wis.	J-3	Cont. 65	50 hr.	April '41			1575
McBoyle Cub Sales, Spring Green, Wis.	Coupe	Cont. 65	50 hr.	March '41			1900
McBoyle Cub Sales, Spring Green, Wis.	J-3	Frank.	98 hr.	Dec. '40			1175
McBoyle Cub Sales, Spring Green, Wis.		Cont. 65		Mar. '41		Mar. & Red	1800
McBoyle Cub Sales, Spring Green, Wis.		Cont. 65		April '41		Yellow	1550
McBoyle Cub Sales, Spring Green, Wis.		Frank. 60		April '41		Yellow	1300
McBoyle Cub Sales, Spring Green, Wis.		Frank. 50		Aug. '40		Yellow	1200
P. A. Meinke, Willoughby, Ohio		Cont.	75 hr.	July '40			550
P. A. Meinke, Willoughby, Ohio		Cont.	475 hr.	June '40			625
Midwest Aviation Sales, LaGrange, Ill.		Frank. 50	406 hr.	March '41	60 hr.	Yellow	850
Mississippi Airways, Inc., Jackson, Miss.		Cont. 50	615 hr.	Sept. '40	May '40	Yellow	950
L. A. Musgrove, Morgantown, W. Va.	Coupe	Cont. 65	250 hr.		none	Red & Cr.	1300
L. A. Musgrove, Morgantown, W. Va.		Frank. 50	180 hr.		none	Yellow	1050
Northway Flyg. Serv., Norton Field, Columbus, Ohio	Coupe	Frank. 60	300 hr.	yes		Red	1350
Northway Flyg. Serv., Norton Field, Columbus, Ohio	Trainer	Cont. 40	275 hr.	yes			725
Northway Flyg. Serv., Norton Field, Columbus, Ohio	Trainer	Frank. 50	475 hr.	yes			1000
Northway Flyg. Serv., Norton Field, Columbus, Ohio	Trainer	Frank. 50	275 hr.	yes			1075
Page Airways, Inc., Rochester, N. Y.	J-3	Lyc. 50	450 hr.	June '40	none	Yellow	1000
Palm Beach Aero Corp., W. Palm Beach, Fla.	Coupe	Cont.	92 hr.	Jan. '41	new	Blue	1195
Palm Beach Aero Corp., W. Palm Beach, Fla.		Cont.	92 hr.	Feb. '41	new	Black	850
Piedmont Aviation Corp., Winston Salem, N. C.	Coupe	Cont. 65	275 hr.	Dec. '40	52 hr.		1450
Piedmont Aviation Corp., Winston Salem, N. C.	Coupe	Cont. 50	178 hr.	Dec. '40	65 hr.		1275
Piedmont Aviation Corp., Winston Salem, N. C.	J-3	Cont. 50	482 hr.	Sept. '40	161 hr.		975
Port Columbus Flyg. School, Ft. Columbus, Columbus, Ohio	Coupe	Cont. 65	95 hr.	yes		Blk., red trim	1250
Rocky Mount Flyg. Serv., Rocky Mount, N. C.		Cont. A-40-4	215 hr.	July '40	215 hr.		800
Rocky Mount Flyg. Serv., Rocky Mount, N. C.		Cont. A-40-4	650 hr.	Sept. '40	40 hr.		550
Safair, Inc., Roosevelt Field, N. Y.	Coupe	Cont. 65	115 hr.	Feb. '41			1725
St. Louis Flyg. Serv., Lambert Field, St. Louis, Mo.	Trainer	Frank. 50	193 hr.	Aug. '40			925
St. Louis Flyg. Serv., Lambert Field, St. Louis, Mo.	Sport	Frank. 50	484 hr.	March '41			975
St. Louis Flyg. Serv., Lambert Field, St. Louis, Mo.	Sport	Frank. 50	172 hr.	July '40			995
St. Louis Flyg. Serv., Lambert Field, St. Louis, Mo.	Sport	Frank. 50	528 hr.	Aug. '40			975
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Tex.	Coupe	Frank. 60	235 hr.	June '40	none		1250
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Tex.	J-2	Cont. 40	560 hr.	May '41	none		575
Seidner Flyg. Serv., SAM Arpt., Youngstown, Ohio		Frank. 60	35 hr.	yes			1200
Seidner Flyg. Serv., SAM Arpt., Youngstown, Ohio		Cont. 65	96 hr.	yes			1495
Southern Airways Sales Co., Birmingham, Ala.		Cont. A-40	500 hr.	Sept. '40		Sil., Bl. trim	575
Southern Airways Sales Co., Birmingham, Ala.		Cont. A-40	500 hr.	April '41		Sil., Bl. trim	600
Southern Airways, Inc., Danville, Va.		Lyc. 55	105 hr.	Sept. '40	none		1200
Southern Airways, Co., Birmingham, Ala.		Cont. A-40	500 hr.	Sept. '40	none		575
Southern Airways, Co., Birmingham, Ala.		Cont. A-40	500 hr.	April '41	none		600
Tenn. Aero Corp., Nashville, Tenn.		Frank. 50	250 hr.	Nov. '40		Yellow	970
Toomey, Gatliff & Webb, Mun. Arpt., Knoxville, Tenn.		Frank. 50	450 hr.	Oct. '40	none	Yellow	900
Toomey, Gatliff & Webb, Mun. Arpt., Knoxville, Tenn.		Frank. 50	800 hr.	Oct. '40	Feb. '40	Red & Yellow	800
Utah Pacific Airways, Inc., Ogden, Utah	Trainer	Lyc. 55	575 hr.	Oct. '40	575 hr.		1000
Utah Pacific Airways, Inc., Ogden, Utah	Trainer	Cont. 50	500 hr.	Sept. '40	25 hr.		900
Virginia Cub Dist., Box 211, Farmville, Va.	J-3	Cont. 50	200 hr.	Aug. '40	none		1450
Virginia Cub Dist., Box 211, Farmville, Va.	J-2	Cont. 40	400 hr.	April '41	none		325
Virginia Stinson Dist., Staunton, Va.	J-2	Cont.	370 hr.	yes	20 hr.	Silver Red	500
Wallace Aircraft Company, Clarcona, Fla.	Coupe	Cont. 65	60 hr.	Feb. '41	new ship		1800
Wallace Aircraft Company, Clarcona, Fla.	Coupe	Cont. 65	60 hr.	Feb. '41	new ship		1800
Wallace Aircraft Company, Clarcona, Fla.	Cruiser	Cont. 75	100 hr.	March '41	new ship		1798
Warsaw Air Serv., 422 S. Union, Warsaw, Ind.		Cont. 40	240 hr.	May '41		Silver	625
W. Va. Air Service, Inc., Co. Airport Clarksburg, W. Va.	J-3	Cont. A-40	119 hr.	Nov. '40	none		845
W. Va. Air Service, Inc., Co. Airport, Clarksburg, W. Va.	J-3	Cont. A-40	490 hr.	April '41	35 hr.		645
W. Va. Air Service, Inc., Co. Airport, Clarksburg, W. Va.	J-3	Frank. 50	80 hr.	Nov. '40	none		1050
W. Va. Air Service, Inc., Co. Airport, Clarksburg, W. Va.	J-3	Lyc. 50	210 hr.	Nov. '40	none		1050
Art Whitaker, Portland Arpt., Portland, Ore.	J-3	Frank. 50	300 hr.	Sept. '40	300 hr.		1100
Art Whitaker, Portland Arpt., Portland, Ore.	J-3 Sport	Frank. 50	600 hr.	Sept. '40	600 hr.		1050
E. W. Wiggins Airways, Inc., Boston Met. Airport, Norwood, Mass.	Coupe	Cont. 65	139 hr.	Jan. '41			1395
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.	J-3	Frank. 50	400 hr.			Yellow	1000
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.		Frank.	640 hr.	Nov. '40	none		910
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.		Frank.	522 hr.	Oct. '40	none		1030
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.		Frank.	523 hr.	Oct. '40	none		1030
DART							
Brayton Flyg. Serv., Lambert Arpt., Robertson, Mo.		Ken-Royce	250 hr.	March '41	200 hr.	Black	2975
Port Columbus Flyg. School, Pt. Col., Columbus, Ohio		Lambert	915 hr.	yes		Blk., red trim	1950
EAGLEROCK							
Thompson Flyg. Serv., Salt Lake City, Utah		Wright J5	1049 hr.	Sept. '40	149 hr.	Yellow	1000
Art Whitaker, Portland Arpt., Portland, Ore.		Wright	1050 hr.	just relic.	250 hr.		650
FAIRCHILD							
Arents Air Serv., Armonk, N. Y.	24	Ranger	409 hr.	June '41	none	Yellow	5200
Calif. Aircraft Corp., LAMet. Arpt., Van Nuys, Calif.	24	Warner 145	400 hr.	relicensed	none	Gr. & Wh.	2250
Calif. Aircraft Corp., LAMet. Arpt., Van Nuys, Calif.	42	Wright 330	1150 hr.	relicensed	160 hr.	R. & Sil.	1375
Carolina Aircraft Sales, Charlotte, N. C.	24	Warner 145	102 hr.	May '40	new ship		5750
Ellis Eno Flying Service, Ft. Dodge, Iowa		Warner 145		Dec. '40	recently	Bk. & Y.	2175
Harrisburg Air Serv., Penn-Harris Arpt., Harrisburg, Pa.	KR-34	Wright	800 hr.	May '41	200 hr.		1100
Intercity Airlines, E. Boston, Mass.	22	Cirrus 90	1080 hr.	Dec. '40	95 hr.	B. & Y.	1000
Leech Aircraft Inc., Roosevelt Field, N. Y.		Warner 125		relicensed			2600
Lynchburg Air Transport & Sales, Lynchburg, Va.		Warner	450 hr.	June '40	100 hr.		3500
FLAMINGO							
Des Moines Flyg. Serv. Inc., Mun. Arpt., Des Moines, Iowa		Wasp 450	3000 hr.	June '41	135 hr.	all metal	1600
FLEET							
Arents Air Serv., Armonk, N. Y.	2	Kinner K-5	1673 hr.	Aug. '40	324 hr.	Red, Cr.	825
Safair, Inc., Roosevelt Field, N. Y.		Kinner	597 hr.	Oct. '40			850
FOKKER							
Al Leeward Aircraft Sales, New Kensington, Pa.	J-6-9	Wright 330		yes			795
GREAT LAKES							
P. A. Meinke, Willoughby, Ohio		Cirrus	900 hr.	July '40			675
Racine Flyg. Serv. Inc.		Cirrus	287 hr.	May '41	27 hr.		950
Racine Flyg. Serv. Inc.		Cirrus	362 hr.	May '41	125 hr.		800

Popular Aviation USED PLANE LISTING OF

DEALERS	MODEL	ENGINE	TIME	LICENSED	OVERH'L'D	COLOR	PRICE
KINNER							
Louisville Flyg. Serv., Inc., Bowman Field, Louisville, Ky.		Kinner K-5	460 hr.	yes		Gr. & Cr.	$ 945
Safair, Inc., Roosevelt Field, N. Y.	Sportster	Kinner	2355 hr.	Apr 40	20 hr.		895
LINCOLN							
Fox Valley Flyg. Serv., Aurora, Ill.	PT	Kinner	1468 hr.	Nov. '39	150 hr.	Red	500
LOCKHEED							
Des Moines Flyg. Serv., Inc., Mun. Arpt., Des Moines, Iowa	VEGA	Wasp 450	1500 hr.	June '40	75 hr.	Yellow-Bl.	3500
LUSCOMBE							
Arents Air Serv., Armonk, N. Y.	8A	Cont. 65	325 hr.	Feb. '41	60 hr.	Blue	1450
Iowa Airplane Co., Mun. Arpt., Des Moines, Ia.		Cont. 65	400 hr.	Sept. '40	400 hr.	Red Stripe	1700
Iowa Airplane Co., Mun. Arpt., Des Moines, Ia.		Cont. 65	350 hr.	Nov. '40	350 hr.	Red Stripe	1750
Iowa Airplane Co., Mun. Arpt., Des Moines, Ia.		Cont. 65	125 hr.	Jan. '41	125 hr.	Red Stripe	1875
W. F. Luke, Schenectady Arpt., Schenectady, N. Y.		Cont. 65	100 hr.	Aug. '41		Red Stripe	1657
Luscombe Airplane Corp., 247 Park Ave., N. Y. C.		Cont. 50	new	June '41	new	Blue Stripe	1650
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 65	335 hr.	Nov. '41		Blue Stripe	1875
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 65	490 hr.	Nov. '41		Blue Stripe	1650
Massey & Ransom Flyg. Serv., Denver, Colo.		Cont. 65	350 hr.	Nov. '41	60 hr.	Blue Stripe	1725
Midwest Aviation Sales, LaGrange, Ill.	8A	Cont. 50	550 hr.	March '41	50 hr.	Silver	1250
Midwest Aviation Sales, LaGrange, Ill.	8A	Cont. 65	385 hr.	April '41	5 hr.	Red Stripe	1550
Page Airways, Inc., Rochester, N. Y.		Cont. 65	400 hr.	April '41	10 hr.	Red Stripe	1700
Page Airways, Inc., Rochester, N. Y.		Cont. 65	200 hr.	Sept. '40	none		1750
MONOCOACH							
Dewey Eldred Flyg. Serv., Willoughby, Ohio		Wright	250 hr.	Aug. '41		Blue & Yellow	700
MONOCOUPE							
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.		Lambert 90	340 hr.	May '41	340 hr.	Bk. & Y.	1550
Ellis Eno Flying Service, Ft. Dodge, Iowa		Lambert 90		July '40	recently	R. & Bk.	800
Sky Harbor, Inc., 3601 E. 38th St., Indianapolis, Ind.		Lambert	275 hr.	Oct. '40	July '39	Wh. & Red	1200
MOTH							
Luscombe Airplane Corp., 247 Park Ave., N. Y. C.		Gypsy Major	no hrs.	June '41	new	Red	4000
PARKS							
Hylan Flyg. Serv., Rochester Arpt., Rochester, N. Y.		Wright 175	514 hr.	Sept. '40	150 hr.		1250
PORTERFIELD							
Airways, Inc., Waterville, Me.		Cont. 40	68 hr.	April '41	new ship		595
Bethany Air Serv. Inc., Amity Rd., Bethany, Conn.		LeBlond	178 hr.	June '40			900
Currey Flying Serv., 781 W. Losey, Galesburg, Ill.		Cont. A-40	500 hr.	July '40	40 hr.	Red	550
Dawson Air Serv., Salina, Kas.		LeBlond 70	not given	yes	April '40	Blk.	800
Geo. C. Haven, Schenectady Ct. Arpt., Schenectady, N. Y.		LeBlond 70	450 hr.	April '41	100 hr.		895
Hood Aircraft Sales, LaFleur Arpt., Northampton, Mass.		LeBlond	700 hr.	Oct. '40	just topped	Red	695
Intercity Airlines E. Boston, Mass.		LeBlond 70	330 hr.	April '41	30 hr.	R. & Bk.	950
W. F. Luke, Schenectady Arpt., Schenectady, N. Y.		LeBlond 70	450 hr.	April '41	100 hr.	Red	895
REARWIN							
Airways, Inc., Waterville, Me.	85	LeBlond 85	280 hr.	Sept. '40	new ship		1000
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.		LeBlond 85	482 hr.	Dec. '40	482 hr.	Silver	950
P. A. Meinke, Willoughby, Ohio	8500	LeBlond	900 hr.	Sept. '40			975
Neil R. McCray, Mun. Arpt., Jamestown, N. Y.		LeBlond	750 hr.	Aug. '40	200 hr.		995
Midwest Aviation Sales, LaGrange, Ill.		LeBlond 90	338 hr.	March '41	50 hr.	Red	1250
A. E. Padage, Tri-City Arpt., Wisc. Rapids, Wisc.		LeBlond 70	734 hr.	Nov. '40	37 hr.	Red	850
A. E. Padage, Tri-City Arpt., Wisc. Rapids, Wisc.		LeBlond 70	177 hr.	May '41	none	Red	1575
Racine Flyg. Serv., Inc., Racine, Wisc.		LeBlond 70	550 hr.	May '41	3 hr.		925
ROBIN							
Clovis Flyg. Serv., Clovis, N. M.		J-6-5	600 hr.	May '41	Feb. top	Red	850
Fox Valley Flyg. Serv., Aurora, Ill.	4 pl.	Challenger	870 hr.	Oct. '39	35 hr.	Bl.	575
Portland Flyg. Serv., Portland, Me.		J-6-5	800 hr.	July '40	45 hr.	Red & Cr.	995
Raymond Aero Service Co., Herbert Smart Arpt., Macon, Ga.		Wright	800 hr.	Dec. '40	Nov. '39	Silver & Blue	950
Safair, Inc., Roosevelt Field, N. Y.		Challenger		Sept. '40			725
Thompson Flyg. Serv., Salt Lake City, Utah		Challenger	825 hr.	June '40	no time	Red, Y. trim	850
Utah Pacific Airways, Inc., Ogden, Utah		J-6-5	1075 hr.	Feb. '41	25 hr. eng.		1100
RYAN							
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Menasco	244 hr.	Aug. '40		Al.	2850
Dockery Air Serv., Box 817, Stuttgart, Ark.		J-5	600 hr.	Apr. '40	Jan. '39	Silver	900
Lynchburg Air Transport & Sales, Lynchburg, Va.	STA	Menasco	550 hr.	March '40	115 hr.		2450
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Texas		J-5 Wright	615 hr.	March '41	21 hr.		875
SIKORSKY							
Luscombe Airplane Corp., 247 Park Ave., N. Y. C.	Amphib.	Wasp	850 hr.	Aug. '40	25 hr.	White	5060
STANDARD							
Virginia Stinson Dist., Staunton, Va.		Kinner B5		yes	60 hr. back	Bl. & Yellow	975
STINSON							
Air Service, Inc., Denver, Colo.	Reliant	Wright	386 hr.	April '41	40 hr. back	Red	5900
J. A. Atherton Co., 2478 University Ave., St. Paul, Minn.	105	Cont. 80	40 hr.	yes		Orange	3295
Baker Eberle Aviation Corp., Detroit, Mich.	105	Cont. 75	10 hr.		Sept. '30	Red & Cr.	2300
Barr Aviation Corp., Detroit, Mich.		Lyc. 215	809 hr.	April '41	5 hr. eng.		950
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia	105	Cont.	246 hr.	July '40		Bl. & Red	2200
Brayton Flyg. Serv., Lambert St. Louis Arpt., Robertson, Mo.		Lyc.	738 hr.	Oct. '40	126 hr.	Y. & R.	1450
Brayton Flyg. Serv., Lambert St. Louis Arpt., Robertson, Mo.		Lyc.	578 hr.	June '40	450 hr.	Bk. & Wh.	7800
Calif. Aircraft Corp., LAMet Arpt., Van Nuys, Calif.	105	Cont. 75	100 hr.	Sept. '40		Dk. B. & R.	2650
Canton Aviation Co., Canton, Ohio		Lyc. 215		May '41	yes	Red & Silver	1200
Carolina Aircraft Sales, Charlotte, N. C.		Lyc.	832 hr.	April '41	9 hr.		1000
Chicago Aviation Corp., Glenview, Ill.		Lyc.	100 hr.	yes	100 hr. since	Red, Wh. trim	2995
Chicago Aviation Corp., Glenview, Ill.			290 hr.	yes		Dk. Bl., Lt. Bl. trim	2295
Dockery Air Serv., Box 817, Stuttgart, Ark.		SR5	650 hr.	April '40	Jan. '39	Blk., Silver	2250
Ellis Eno Flying Service, Ft. Dodge, Iowa		Lyc. 245	Oct. '40		recently	R. & B.	1950
G & R Air Services, 600 N. Columbus St., Alexandria, Va.	SM8A	Lyc. 215	1250 hr.	Sept. '40	Aug. '39	Bk., Or.	1095
Gillis Flyg. Serv., 125-1st Ave., N., Great Falls, Mont.		Lyc. 215	800 hr.	Nov. '40	240 hr.		1300

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL	ENGINE	TIME	LICENSED	OVERH'L'D	COLOR	PRICE
Harrisburg Air Serv., Penn-Harris Arpt., Harrisburg, Pa.		Lyc.	700 hr.	Dec. '41	175 hr.		$1300
Geo. C. Haven, Schenectady Ct. Arpt., Schenectady, N. Y.	105	Cont. 75	90 hr.	Sept. '40	none		2550
Intercity Airlines, E. Boston, Mass.	105	Cont. 75	430 hr.	June '40	just majored	B. & R.	2150
Intercity Airlines, E. Boston, Mass.	105	Cont. 75	315 hr.	Aug. '40	none	B. & R.	2200
Leech Aircraft, Inc., Roosevelt Field, N. Y.	105	Cont. 75	88 hr.	yes		Bl. & Cr.	2600
Leech Aircraft, Inc., Roosevelt Field, N. Y.	105	Cont. 75	24 hr.	yes		Bl. & Y.	2700
Neil R. McCray, Mun. Arpt., Jamestown, N. Y.	105	Cont.	16 hr.	Nov. '40	16 hr.		2600
Neil R. McCray, Mun. Arpt., Jamestown, N. Y.		Lyc. 215	1100 hr.	July '40	300 hr.		995
Morey Airplane Co., Madison, Wisc.		Lyc.	800 hr.	yes	350 hr.	Blk. & Silver	1900
Morey Airplane Co., Madison, Wisc.		Lyc.	unknown	yes	needs none	Blk. & Silver	2200
Page Airways, Inc., Rochester, N. Y.		Lyc.	1500 hr.	Oct. '40	250 hr.	Blk. & Yellow	1750
Palm Beach Aero Corp., W. Palm Beach, Fla.	105	Cont.	225 hr.	Aug. '40	new	Blue	2150
Portland Flyg. Serv., Portland, Me.		Lyc. 260	750 hr.		1939	Red & Cr.	3500
Raymond Aero Service Co., HerbertSmart Airport, Macon, Ga.		Wasp Jr.	950 hr.	July '40	March '38	B. & W.	2000
J. L. Schroeder, Inc., Rt. 3, Box 117 Houston, Texas		Lyc.	432 hr.	Nov. '40	150 hr.		1250
Sioux Skyways, Sioux Falls, S. Dak.,		Lyc. 260	235 hr.	June '40	235 hr.	Red	7200
Sioux Skyways, Sioux Falls, S. Dak.	105	Cont. 75	225 hr.	July '40	25 hr.	Blue	2500
P. J. Sones Co., Haines City, Fla.	105	Cont.	175 hr.	July '39	none	Bl., Red Stripe	2350
Southern Airways Sales Co., Birmingham, Ala.	105	Cont. A-75	150 hr.	Oct. '40		Bl., Red trim	2500
Southern Airways Sales Co., Birmingham, Ala.	105	Cont. A-75	150 hr.	Oct. '40	none		2500
R. Turner Aero. Corp., Indianapolis, Ind.	105	Cont. 75	165 hr.	Sept. '40	none	Blue	2600
Virginia Stinson Dist., Staunton, Va.	R680	Lyc.		yes		Bl. & Or.	700
Virginia Stinson Dist., Staunton, Va.	105	Cont. 75	80 hr.	yes		Blue	2400
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.	105	Cont. 75	200 hr.	yes			2300
E. W. Wiggins Airways, Inc., Boston, Met. Arpt., Norwood, Mass		Lyc. 245	1085 hr.	March '41	15 hr.		3900
TAYLORCRAFT							
Baltimore School of Aero., Curtiss-Wright Arpt., Baltimore		Lyc.	415 hr.	Oct. '40		Blue	1200
Baltimore School of Aero., Curtiss-Wright Arpt., Baltimore		Lyc.	341 hr.	Oct. '40		Blue	1200
Baltimore School of Aero., Curtiss-Wright Arpt., Baltimore		Lyc.	227 hr.	Oct. '40		Blue	1200
Baltimore School of Aero., Curtiss-Wright Arpt., Baltimore		Frank.	693 hr.	Jan. '41	183 hr.	Red	1100
Blvd. Arpt., Inc., Roosevelt Blvd., Philadelphia		Cont. 40	400 hr.	Sept. '40	100 hr. ago	Gray	700
Brayton Flyg. Serv., Lambert Arpt., Robertson, Mo.		Cont.A-40-4		just lic	just ovr.	Cr. & Bl.	945
Canton Aviation Co., Canton, Ohio		Lyc. 50	291 hr.	Jan. '41	yes	Cr., Red Stripe	1150
Currey Flyg. Serv., 781 W. Losey, Galesburg, Ill.		Cont. A-40	500 hr.	July '40	50 hr.	Gray	700
Dawson Air Serv., Salina, Kans.		Cont. 40	500 hr.	yes	recently	Maroon	750
Dewey Eldred Flyg. Serv., Willoughby, Ohio		Cont. 40		Nov. '41		Bl. & Red	850
Dewey Eldred Flyg. Serv., Willoughby, Ohio		Cont. 40		July '40		Maroon & Cr.	700
Fox Valley Flyg. Serv., Aurora, Ill.		Lyc. 65	106 hr.	July '39		Bl.	1475
Hood Aircraft Sales, LaFleur Arpt., Northampton, Mass.		Cont. 40	550 hr.	July '40	125 hr.	Red	850
K. Johannesson Flyg. Serv., Stevenson Arpt., Winnipeg, Can.		Cont. A403	800 hr.			navy grey, Ver.	1250
K. Johannesson Flyg. Serv., Stevenson Arpt. Winnipeg, Can.		Cont.A-403	800 hr.			Br. Gr. Sil.	1250
Leavens Bros., Barker Arpt., Toronto, Can.		Cont.A-50-3	1095 hr.	Sept. '39		Berry Red	1600
Leavens Bros., Barket Arpt., Toronto, Can.		Cont.A-50-5	614 hr.	April '40		Blue	1750
Leavens Bros., Barker Arpt., Toronto, Can.		Cont.A-40	1172 hr.	April '40		Berry Red	1100
W. F. Luke, Schenectady Arpt., Schenectady, N. Y.		Frank. 50	350 hr.	Oct. '41		Gray	825
L. A. Musgrove, Morgantown, W. Va.		Lyc.	60 hr.	Sept. '40	none	Red	1400
Northern Okla. Flyg. Serv., Mun. Arpt., Blackwell, Okla.		Frank.	80 hr.	Jan. '41	like new	Black	1300
Northern Okla. Flyg. Serv., Mun. Arpt., Blackwell, Okla.		Cont. A-40	1310 hr.	April '41	1260 hr.		800
Palm Beach Aero Corp., W. Palm Beach, Fla.		Cont.	342 hr.	Dec. '40	Dec. '39	Gray	695
Pt. Columbus Flyg. School, Pt. Col., Columbus, Ohio		Lyc.	867 hr.	yes		Blk. Red trim	1000
Pt. Columbus Flyg. School, Pt. Col., Columbus, Ohio		Lyc.	692 hr.	yes		Blk. Red trim	1100
Raymond Aero Serv. Co., Herbert Smart Arpt., Macon, Ga.		Lyc.	685 hr.	Dec. '40	March '40	Cr. & Red	1250
Raymond Aero Serv. Co., Herbert Smart Arpt., Macon, Ga.		Cont.	550 hr.	Oct. '40	Nov. '39	Cr. & Red	1150
Rochester Aero Corp., Rochester, N. Y.		Lyc.	475 hr.	June '41	25 hr.	Blue	1100
Rochester Aero Corp., Rochester, N. Y.		Lyc.	250 hr.	Oct. '41			1500
Sioux Skyways, Sioux Falls, S. Dak.		Cont. 40	600 hr.	Feb. '41	65 hr.	Black	785
Sky Sport Associates, Inc., Sharonville, Ohio		Cont. A-40	975 hr.	June '40	192 hr.	Gray trim	650
A. R. Smith, 113 E. Commerce St., Aberdeen, Miss.		Cont. A-40	800 hr.	Oct. '39	Oct. '39	Gray	725
Southern Airways Sales Co., Birmingham, Ala.		Cont.	500 hr.	April '41		Blk., Red trim	700
Southern Airways Co., Birmingham, Ala.		Cont.	500 hr.	April '41	none		700
Stinson Flyg. Corp., 1044 Airway, Glendale, Calif.		Cont. A-40	1300 hr.	yes	161 hr.	Bl. & Sil.	700
R. Turner Aero. Corp., Ind., Ind.		Cont. A-40	380 hr.	June '40	70 hr.	Gray	775
R. Turner Aero. Corp., Ind., Ind.		Frank. 50	247 hr.	Nov. '40	top	Cr. & Blue	1200
Warsaw Air Serv., 422 S. Union, Warsaw, Ind.		Cont.	360 hr.	March '41		Black	795
TRAVELAIR							
Calif. Aircraft Corp., LAMet. Arpt., Van Nuys, Calif.	A-140	Wright	1082 hr.	relicensed	20 hr.	Y. & B.	1750
Chicago Aviation Corp., Glenview, Ill.		Wright	240 hr.	yes			995
Des Moines Flyg. Serv., Inc., Mun. Arpt., Des Moines, Iowa		Warner 125	800 hr.	Aug. '40	140 hr.	Bl., Or.	745
Hudson Valley Air. Co., 68 Dolsonn Ave., Middletown, N. Y.		Kinner 100	800 hr.	June '41	3 hr.		750
Jones Flyg. Serv., Sullivant Ave. Arpt., Columbus, Ohio		Wright J-5	500 hr.	Oct. '40	May '38	Ivory	1250
Racine Flyg. Serv., Inc., Racine, Wisc.		Gypsy	172 hr.	Feb. '41	none		900
Stinson Flyg. Corp., 1044 Airway, Glendale, Calif.		330 h.p.	1039 hr.	yes	5 hr.	Red	2000
Toomey, Gatliff & Webb, Mun. Arpt., Knoxville, Tenn.		J69-330	300 hr.	April '41	May '38	Blue	2000
Art Whitaker, Portland Arpt., Portland, Ore.		Wright	800 hr.	just relicensed	85 hr.		1650
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.		Wright J-5	608 hr.	Oct. '40	81 hr.		1600
WACO							
Aero-Ways, Inc., Cleveland, Ohio		Warner	801 hr.	Sept. '40		Cream	950
Airways, Inc., Waterville, Me.	Cabin	Cont. 210	640 hr.	Aug. '40	138 hr. since		1600
Air Service, Inc., Denver, Colo.		Jacobs 225	900 hr.	Aug. '40	175 hr. back	Blue	2400
Aviation Serv., Inc., P.O. Box 308, Newport News, Va.	F	Kinner B-5	650 hr.	May '41	100 ship		1200
Beebe Air Service, Hastings, Nebr.		Cont.	450 hr.	Jan. '40	Dec. '39	Red	2000
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	F-3	Jacobs 225	508 hr.	Feb. '41	17 hr.	Black	2500
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	UKC	Cont. 210	550 hr.	May '40	550 hr.	R. & Cr.	1550
Chapman Air Service, New Orleans, La.		Warner	unknown	Nov. '40	50 hr. since	Red & Sil.	1050
Chicago School of Aero., Inc., Palwaukee Arpt., Mt. Prospect, Ill.		Jacobs	790 hr.	yes	150 hr.	Br., Cr.	3665
Cincinnati Aircraft Serv., Cincinnati, Ohio	F	Warner 125	950 hr.	June '40		Red & Sil.	925
Clinton Co., Arpt., DeWitt, Iowa		Warner 125	450 hr.	April '41	100 hr.		1500
Currey Flying Serv., 781 W. Losey, Galesburg, Ill.		Tank	500 hr.	June '41	30 hr. ago	Red & Sil.	550
Des Moines Flyg. Serv. Inc., Mun. Arpt., Des Moines, Iowa	F	Warner 125	688 hr.	June '40	10 hr.	Red, Sil.	995
Dockery Air Serv., Box 817, Stuttgart, Ark.		J-5	700 hr.	Oct. '40	Nov. '39	Red, blk. stripe	1250
Frantz Flyg. Serv., Roanoke, Va.		Cont. 165	475 hr.	yes		Red	1275
Geo. C. Haven, Schenectady Co. Arpt., Schenectady, N. Y.	F	Warner 125	1000 hr. ship	April '41	200 hr.		1100
B. F. Hines, Mex.-Tex. Arpt., Hobbs, N. M.		Jacobs 210	400 hr.	yes			2100
Lexington Flyg. Serv., Inc., Mun. Arpt., Lexington, Ky.		Jacobs	680 hr.	yes	127 hr.	Red	1475
Louisville Flyg. Serv., Inc., Bowman Field, Louisville, Ky.		Cont. 210	768 hr.	yes		Blue	1195
Neil McCray, Mun. Arpt., Jamestown, N. Y.	F	Warner	675 hr.	July '40	75 hr.		1095
H. G. Mayes, Huntington Arpt., Huntington, W. Va.	F	Warner 125	1273 hr.	Dec. '40	Oct. '39	Red & Sil.	1250
Miss. Airways, Inc., Jackson, Miss.		Jacobs 225	295 hr.	June '40		Bl. & Cream	2800
Seidner Flyg. Serv., SAM Arpt., Youngstown, Ohio		Wright	791 hr.	March '41	40 hr.		1200
Sioux Skyways, Sioux Falls, S. Dak.		Jacobs 225	750 hr.	June '40	300 hr.	Blue	2985
Southern Airways, Inc., Danville, Va.		Jacobs 225	872 hr.	May '41	436 hr.		2150
Southeast Kans. Aircraft Serv., Chanute, Kans.	F	Warner		Aug. '40	150 hr. back	Ver.	1150
Tenn. Aero. Corp., Nashville, Tenn.		Cont. 210		April '41		Wh. with Blk.	2000
Thompson Flyg. Serv., Salt Lake City, Utah		Kinner B-5	1790 hr.	May '41	140 hr.	Ver.	1150
R. Turner Aero. Corp., Indianapolis, Ind.		Jacobs 225	unknown	May '40		Bl. & Red	2750
Warsaw Air Serv., 422 S. Union St., Warsaw, Ind.		Warner 125	900 hr.	April '41	45 hr.	Red	1275
E. W. Wiggins Airways, Inc., Boston Met. Arpt., Norwood, Mass.		Cont. 210	1100 hr.	Sept. '40	169 hr.		1350

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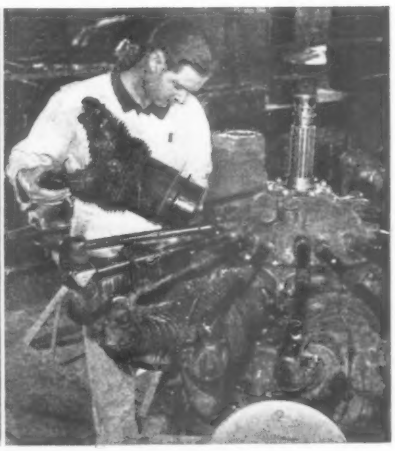

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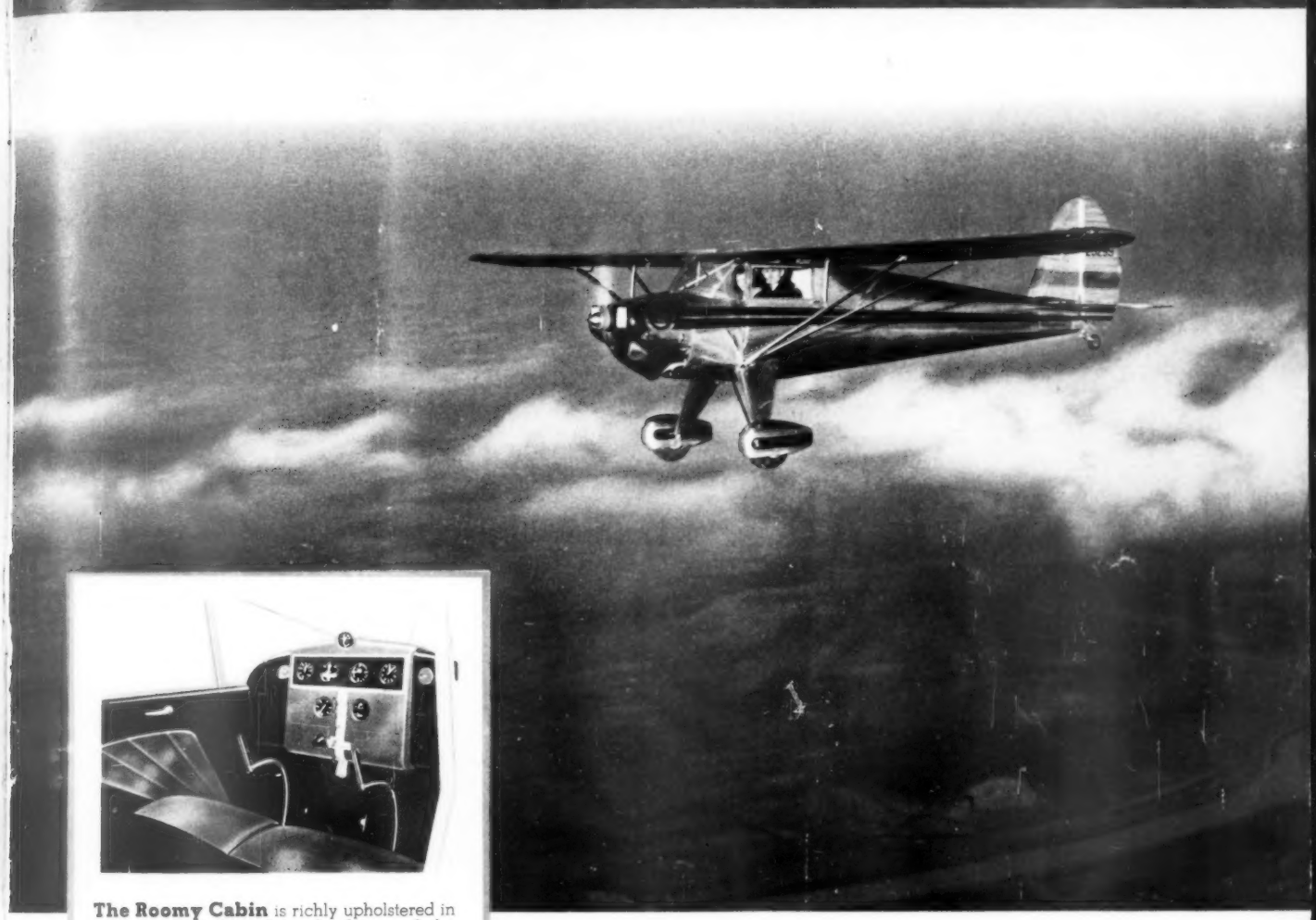
MODERN AS TOMORROW
THE SILVAIRE BY LUSCOMBE



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